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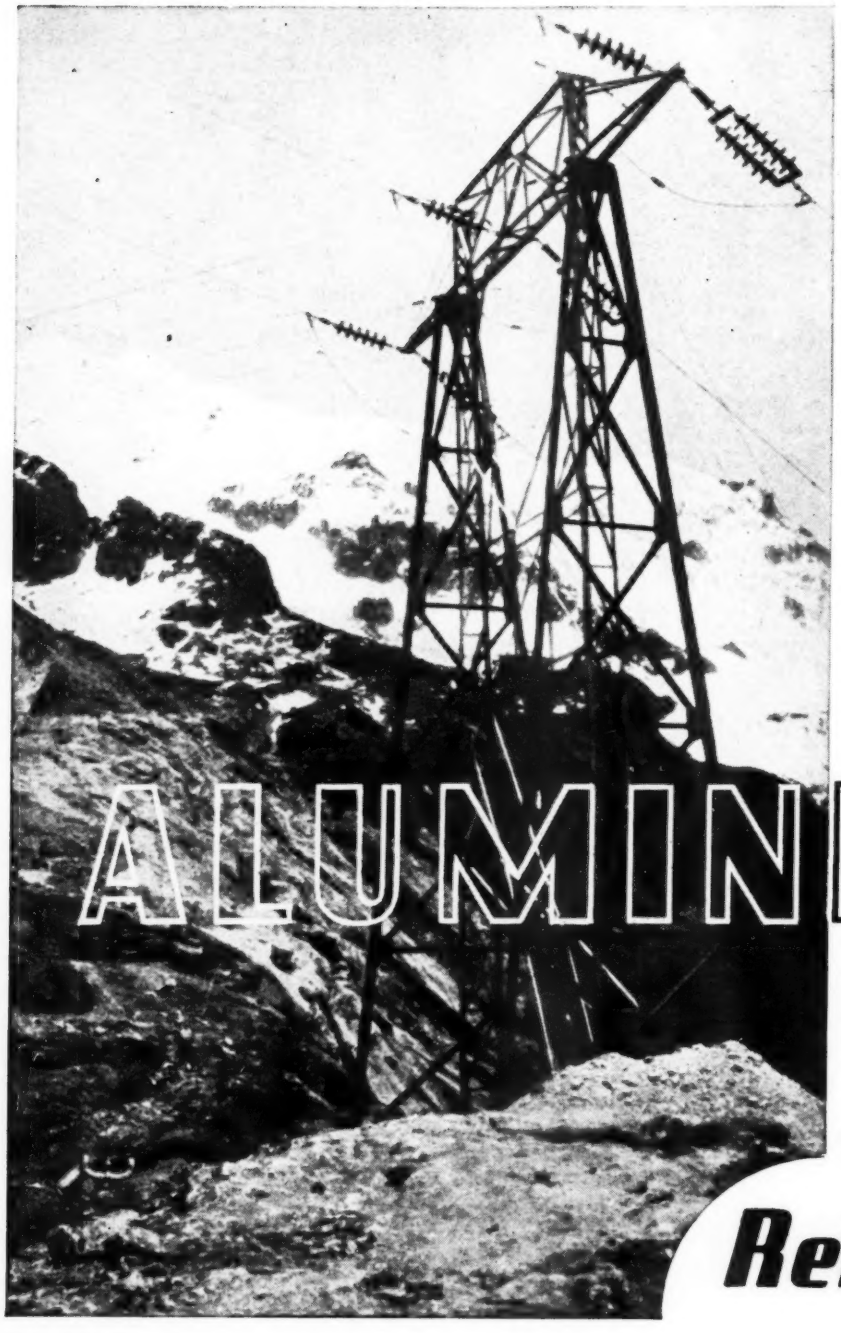

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The
Electrical Review

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A Promising Outlook

SELDOM, indeed we think that we may say never before, has the British electrical industry looked forward to a year of progress and prosperity with better reason than to-day.

There has been a succession of fairly definite movements begun or extended during the past twelve months which in the aggregate indicate that all-round development of demand has taken place affecting practically every branch of manufacturing, construction, and installation. There is good reason for hoping that there will not be a slowing down of activity for several years; the indications indeed are that in most departments we shall either recover lost ground or improve on recent rates of progress, but it is impossible to foresee everything, and calculations are easily upset.

If, however, we have definitely left the slump period behind us, and trade revival and stability spread to other countries, the electrical engineering industries of this country should benefit during the next five years from a bigger advance toward general electrification, private and public, industrial and railway, than in any other similar period.

If we limit our outlook to the year 1936 we need only refer to the improved state of the order books and employment rolls of the great electrical and allied manufacturing companies, and to the hopefulness which permeates many specialised smaller businesses.

The home demand for everything electrical has been growing, the stimulus coming from new measures which have made possible the placing of numerous very substantial contracts for electricity supply station equipment and distribution work and for the very welcome, because so long awaited, railway electrification, and, of course, for big industrial installations.

Then the addition of half-a-million domestic consumers per annum means a substantial continuous growth in the need for many kinds of small products. But what we shall continue to recognise is the great benefit that can come to the industry as the Empire and other overseas lands increase their capacity to purchase from us the great equipment and multitude of small lines which are the inevitable needs of all parts of the globe as the world electrification pace is accelerated.

The figures which were quoted in our last issue show that our electrical exports advanced at a healthy rate up to the end of November, but 1936 will undoubtedly show a better record as the result of recently placed orders and the preparation of plans that are now in progress. May we soon witness a return to the excellent figures of our best years.

No laboured elaboration is needed to justify the hopes thus outlined. Briefly stated, the position is as follows: Big developments are taking place in the home market; the task of winning the potential consumer of electricity is being tackled in earnest; industrial revival and stability have increased employment; and, given peace and quiet in which the people of all lands can proceed with the utilisation and development of their own resources and engage in international trade, the overseas orders should increase substantially.

Certainly, as we try to see it now, 1936 promises to be an excellent year electrically at home and overseas.

Training for Management

SOME men are born managers; others become so by early availing themselves of the specialised education and training that are now placed at their command. Most of us could quote examples of highly qualified managers and administrators who have grown up with their jobs, and have added to their general fitness while passing through the mill of practical experience. No doubt British industry will produce many more such men, who will succeed under any conditions, but the new movement and facilities will equip many others for those higher posts in business organisation which modern requirements are creating. Indeed, all future managers, whether born or made, will be better qualified to give sound and strong leadership if they recognise the value of the opportunities that now exist for

learning the most up-to-date and reliable methods. "Training for Management" was the theme of a paper read on Tuesday last week by Mr. H. N. Munro before the Manchester Branch of the British Works Managers' Association. It showed the need for more trained managers to meet the changing conditions of modern industry, and gave particulars of the staff training schemes that have been introduced by various concerns and by education authorities. Some attention is, of course, given to the kind of man suited to bearing the responsibilities of management, and means for selection of the right men to undergo training are reviewed. Mr. Munro obviously holds that because an engineer can design a power station he is not necessarily fitted to sell electricity. He says that the consensus of opinion is that there is, and is likely to be for some time to come, a dearth of first-class administrators, and means must be found to provide industry with administrative brains. Those who are interested in the subject will find worth while a study of the paper, with its suggestions how industry can help.

Installation Inspection

DURING the next few weeks the number of people attending places of amusement of all kinds will be greater than usual and the warning given by Mr. J. P. Blake, the chairman of the L.C.C. Entertainments Committee to the proprietors of theatres, cinemas and restaurants is, therefore, most timely. The Council's rules require licensees to have their electrical installations and boilers tested and examined every fourteen months and to submit certificates showing that this has been done. The chairman referred to the loss of life in the recent Wimpole Street fire, which inspection by a qualified electrical engineer should have prevented. The rare nature of such an occurrence may cause elementary precautions to be neglected, but the claims of public safety clearly justify the strong line taken by the Council in deciding to refuse renewal of licences unless adequate evidence is submitted that the rule has been complied with. Other authorities please copy.

Electrical Ironmongers

MR. E. B. HOLLOWAY, the hon. secretary of the Electrical Section of the Ironmongers' Federated Association, comments in this issue upon our leader of December 13th—"The Ironmongers' Claim." He tells us that the ironmongers have fought against municipal trading for many years past. Be that as it may, the resolution passed by the committee of Mr. Holloway's Section gave us the impression that it was not fully acquainted with all that had been done regarding municipal *electrical* trading. The resolution asked the Electricity Commissioners to do something which Parliament hesitated to do, but which the electrical industry has been endeavouring to accomplish by voluntary means for many weary years—to stop, or to put the brake on, municipal competition. Mr. Holloway evidently misunderstood us when we emphasised the electrical character of the Fair Trading Council. We thought that we had made it clear that, while we fully appreciated the electrical ironmongers' claim to recognition and representation, there already existed bodies through which they could achieve their aims.

Contractors and Radio

MR. HOLLOWAY'S reference to the proposal of the Electrical Contractors' Association to form a section for its members doing wireless business opens up a rather different question. In the earliest days of broadcasting electrical contractors were the only radio dealers, for, after all, radio was an electrical development. Then hordes of nondescript manufacturers and dealers saw their opportunity and showered upon the public innumerable components and accessories, which the public built up into radio sets. In this way the electrical dealers were practically forced out of the business. As matters developed, the construction of efficient receivers got beyond the capabilities of the ordinary layman, and the business was confined to a somewhat limited portion of the population. Now the predominance of the all-mains set has still further complicated matters, and, moreover, has made the radio receiver still more of an electrical job. Therefore, we think, the electrical contractor can justifiably claim to be the right person to supply and install (for proper installation is an important matter) modern all-mains receivers. In doing so we do not think that he is overstepping his bounds, nor that his Association is wrong in recognising that side of the electrical business.

Left Out

THE list of members of the Royal Commission (Lord Rockley, chairman) appointed to inquire whether any modification of the Coal Mines' Act of 1911 is needed to promote the health and safety of the workers, contains the name of no electrical engineer. The inclusion of Sir Henry Walker, the Chief Inspector of Mines, will no doubt ensure that due recognition is paid to the beneficial results of electrification in the past, but the Commission will be expected to make recommendations regarding future practice. Considering the influence of adequate lighting and motive-power equipment on health and safety and the key position of electricity in this connection, the omission is surprising. The addition of an independent electrical authority who has studied mining conditions—the name of Professor W. M. Thornton, last year's president of the Institution of Electrical Engineers, immediately suggests itself—would add weight to the findings of the Commission outside as well as within the electrical industry.

Work in Hand

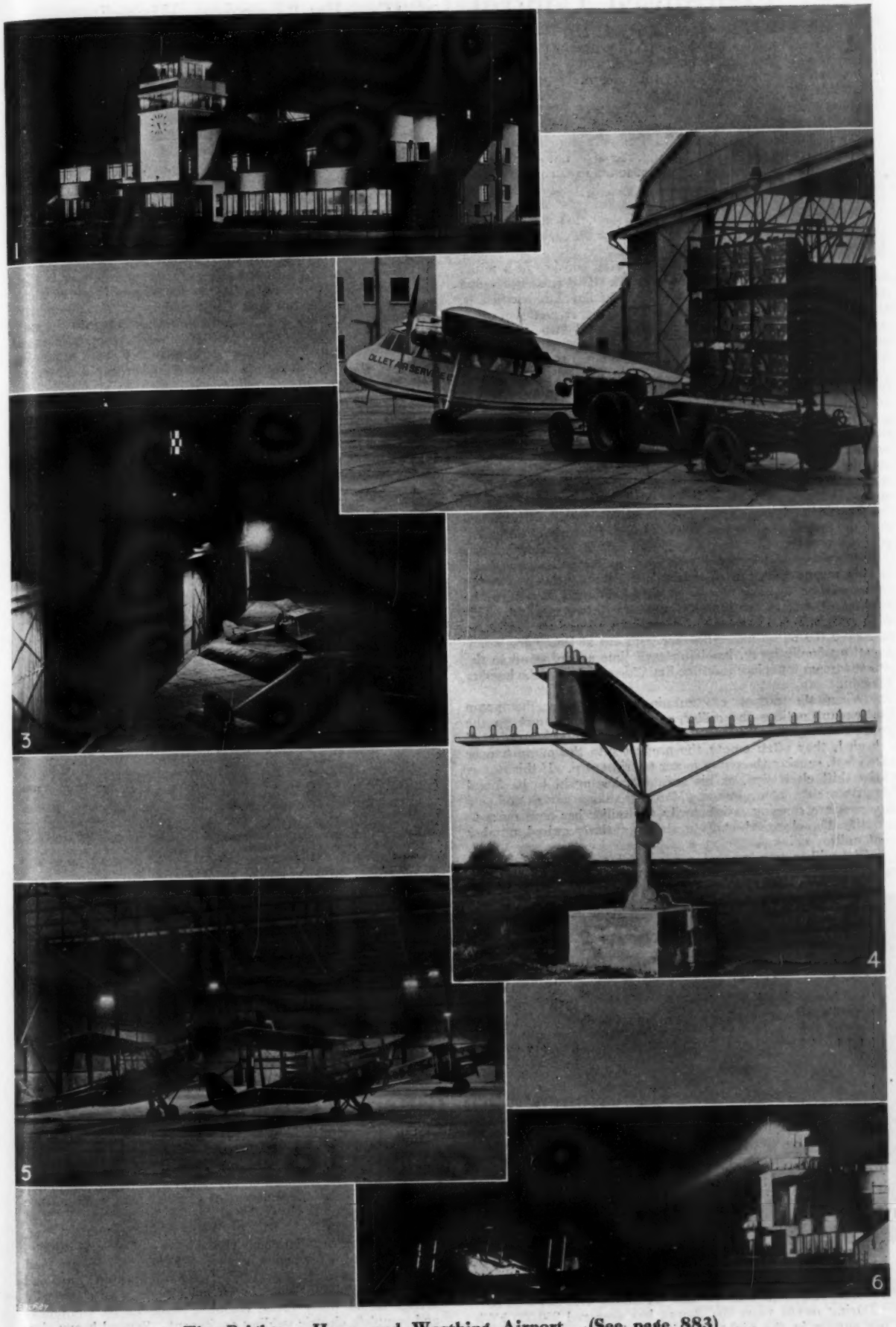
AN indication of the way things are moving can often be obtained by walking round the machine shops of manufacturers of a large diversity of plant. Thus, certain tendencies in power-station practice may be deduced from the number of 33-kV alternators now being built or from the size of motor that is direct-started (*e.g.*, 700 h.p. for the Fulham feed-pumps). The demand for pole-mounting transformers and simple switch- or fuse-gear is notable at one end of the scale of distribution; at the other end is the inclusion of associated apparatus in the rupturing-capacity test of circuit-breakers. One maker informs us that the oil-immersed metal-clad reactor is returning to favour; another draws attention to the accelerating trend towards remote and supervisory control of sub-stations and the use of rectifiers for railways. D.c. is in the ascendant once more for rolling mill drives, for which its flexibility in speed variation makes it more popular than a.c. A particularly satisfactory feature of the frequency change-over schemes is that industrialists appear to be making the most of the opportunity thus provided to modernise their driving arrangements.

The Dangers of Prophecy

TAUNTON'S claim to have been the first town to have a permanent electric street-lighting system has inevitably aroused controversy. Eastbourne, the City of London, Middlesbrough, Godalming, and Chesterfield have all been mentioned in this connection. But whatever the truth may be it is interesting to note what the *Journal of Gas Lighting* had to say in 1879 about the young pretender (as reported in our issue of Oct. 15th, 1879, p. 337):—

> "It is a noteworthy and curious circumstance that every trial of electric lighting, however successful, only serves to prove its utter general impracticability as a general illuminator, and the impossibility of its ever, in the slightest degree, competing with or interfering with the progress of gas lighting."

Our contemporary was referring to the lighting of the piers and promenade at Blackpool, which attracted many thousands of people to the town.



The Brighton, Hove, and Worthing Airport. **(See page 883)**

A night view of the terminal building. 2. The bank of floodlights mounted on its chassis. 3. The beacon and apron lights to enable maintenance work to be carried out at night. 4. The illuminated wind indicator. 5. Inside the hangar. 6. Searchlight on the control tower trained upon a machine.

Centralised Control Gear. By "London River"

The operation of high production plant

THE value of high-production plant is often very heavily discounted by the use of unwieldy hand-operated and scattered motor control gear. One case of many within my personal experience will serve to show what saving could be made, and how production could be increased, by a change over to centralised electrical control.

The plant involved consists of a grinding mill of seven units, each driven by a 750-h.p. 3,000-V auto-synchronous motor, three Lehigh-Fuller pumps, four screw conveyors, and four air compressors. This plant is laid out at present as shown herewith, the motor-room housing the seven main motors and their switchgear and starters, the switchgear for the Lehigh-Fuller pumps, the starters for the screw conveyors, and one of the four air compressors.

In the grinding mill the operating staff consists of a miller and a pump attendant on each shift. The sub-station and motor-room are in charge of a shift electrician and an assistant, the shift electrician having under his supervision the whole of the electrical plant of the factory and two other sub-stations as well. I do not suggest that any change will affect the number of men, as there are only two whole-time attendants in the mill per shift, with two part-time men on the electrical side, so it is evident that there is no scope here for any saving.

As the grinding mill works normally twenty-four hours per day for 365 days per year, it will readily be appreciated that no lost time can possibly be made up again, and is therefore a dead loss from the production point of view. The present method of operation is as follows: When getting away from a complete shut-down the shift electrician, or his assistant, is notified and proceeds to start up the air compressors. When the requisite working pressure is obtained the pump attendant blows out the pipe lines, and when all is in order he goes to the sub-station and requests that the pumps be started up. This means that the electrician's assistant must go to the motor-room to close the circuit-breakers, and round to the grinding mill to operate the auto-transformer starters. This operation generally has to be carried out at least twice, as usually the pump motor breaker trips out at least once before getting finally away, involving each time a trip round to the motor-room to replace the time-limit fuses and close the breaker again.

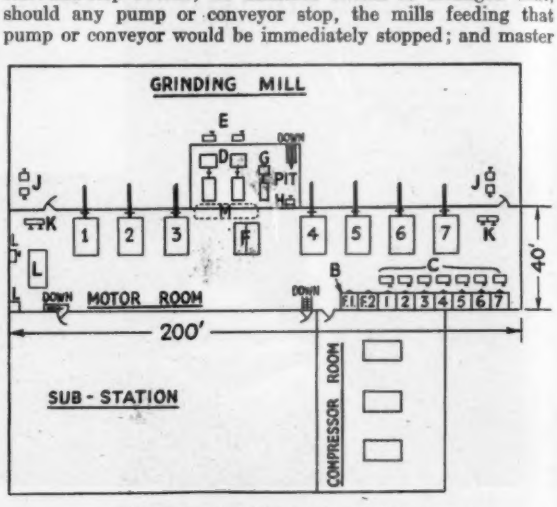
When the pumps are running satisfactorily the pump attendant notifies the miller, who proceeds to start up the screw conveyors. When these have shut down, or been stopped loaded, they often empty the product into the pump hopper too fast, causing the pump motor to trip again. If this occurs the shift electrician, or his assistant, has again to be found to restart the pump motor. Moreover, when pumps and conveyors are running satisfactorily the miller has once more to notify the electrical staff to start up the required number of mills.

The mill motors are each controlled by an e.h.v. truck-type circuit-breaker (hand-operated) and a handwheel controlled (slow motion) liquid rotor starter. This operation has to be carried out with each mill individually, and it often occurs that before he has started the last mill the miller is running round stopping the plant because either the pump motor has tripped out or one of the screw conveyors has broken. The whole sequence of operations has to be gone through again. All this takes considerable time. At a conservative estimate, 1.5 mill-hours are lost in this way four times each day, giving the mills a mean output of 12 tons per hour. With the value of the product at 10s. per ton we get an annual loss of 1.5 by 4 by 365 x 12 x 10s., which is equal to £17,143.

By observation, I allocate 75 per cent. of this lost time to compulsory stoppages due to mechanical troubles and 25 per cent. to the scattered and slowly operated manual switchgear. So there is a minimum loss on the latter account of £4,286 per year, which goes on continuously.

I estimate that to centralise the whole control on one desk control panel, situated in a glass cubicle overlooking the grinding mill, and to modify the existing e.h.v. circuit-breakers for electrical operation and the starters for motor operation, with all necessary wiring, new overload relays and earth-leakage relays, would cost approximately £2,500. It is thus evident that here is an opportunity of saving a considerable amount of money; also, that with an increased output the overhead charges would be correspondingly reduced.

Another aspect which would justify the change-over is that of safety, for the man starting up the motors is out of sight of the mills, and has only the verbal instructions from the miller on which to work. He has often to run into the mill to satisfy himself that all is clear before starting, this again causing a loss of grinding time. The control board suggested should be fitted with an ammeter for each motor stator; a start-and-stop switch; an interlock switch so arranged that, should any pump or conveyor stop, the mills feeding that pump or conveyor would be immediately stopped; and master emergency switches should also be fitted in the mill and in the motor-room to stop the whole of the plant. I have not mentioned the air compressors, as the manually operated gear is quite satisfactory for those, since they are seldom stopped (only for oiling or repairs).



Layout of motors and switchgear

Nos. 1 to 7, 750-h.p. 3,000-V auto-syn. motors. B.—Seven truck panels for motors and two feeder panels. C.—Liquid starters for motors. D.—Two 100-h.p. 3,000-V pump motors in pit. E.—Two auto-transfmr. starters for above. F.—Two truck type panels for pumps. G.—50-h.p. 500-V s.c. ind. motor for pump. H.—Star-delta starter for G. J.—Four 20-h.p. 500-V s.c. ind. motors. K.—Star-delta starters for J. L.—Air compressor with switchgear and starter. M.—Suggested control cubicle over looking grinding mill and pump pit.

It appears that all the advertising of control specialists has not yet convinced manufacturers, or even mechanical engineers, of the advantages of efficient and centralised control gear. They are apt to look at these things as pretty scientific toys rather than as money savers and actual output producers. I shall be well satisfied if this attempt to show what can be done in an actual case helps to convert the unbelievers.

Experience with Battery Vehicles

THE most important arguments in favour of the adoption of electric battery vehicles, says H. Witte in *Elektrische Wirtschaft*, are their effect on national exchange and on the night load of electricity stations. The exchange requirements needed to buy fuel for a diesel vehicle are about ten times as great as those required to maintain the lead plates in a battery vehicle of equal capacity. The German Berliner Städtischen Elektrizitätswerken A.G. (Bewag), has had eight years' operating experience with electric battery trucks. The latter save their cost in one year by reducing the time necessary to get men to jobs, the speed averaging 20 km. (12½ miles) an hour, compared with 3.5 km. (2¼ miles) with hand-carts.

During recent years the Bewag has averaged 250,000 kWh per annum in the night charging of batteries in 110 of its own and twenty other electric vehicles. The difference in operating costs compared with petrol vehicles is ten or eleven per cent. in favour of the battery vehicles (excluding the drivers' wages), and, allowing for the fact that any workman can drive an electric vehicle, the total saving is sixty per cent.

There are at present eighteen fully automatic charging stations, with sixty-five connections, in the Bewag works. At 10,000 kWh per connection per annum the cost (including interest, depreciation, replacement of resistances, maintenance and supervision) is about 3.4 pf. (0.41d. at par) per kWh of charging energy in 3-ph. to d.c. installations and 1.3 pf. (0.16d.) in d.c. installations. The chief use of electric vehicles by the Bewag is for mains service. Electric vehicles are used with electrically driven windlasses for hauling cable drums and drawing-in cables. Other electric vehicles carry an electrically driven thrust borer press, complete cable-testing equipment and complete electric-welding equipment. Several heavy electric lorries and a meter-transport vehicle are also used. Recently a 10-ton electric battery tractor has been put in service for long runs in outer suburban districts. This vehicle has its own charging equipment, which can be connected to the local a.c. or d.c. network, as required.

LIGHTING AT AN AIRPORT

THE importance to the electrical industry of the acceleration of civil aviation development was brought home to us during a recent visit to the new Brighton, Hove and Worthing Municipal Airport at Shoreham, Sussex, when Mr. Stavers H. Tiltman, L.R.I.B.A., the architect responsible for the design and equipping of the airport and to whom we are indebted for the information in this article, told us that out of a total cost of £55,000 (including the cost of the site) the electrical equipment and works cost £3,230. Already services have been established to and from such places as Portsmouth, Bristol, Birmingham and Liverpool, and these will be greatly augmented.

Situated about half-way between Brighton and Worthing,

One of the plug points for supplying landing lights, with one of the boundary lights in the rear

the airport is flanked by the main Brighton and Worthing road and is the first British airport to have a railway station actually on the site. From the electrical point of view, in order of importance, the main components are the aerodrome proper, with an area of about 140 acres, the main hangar, which will accommodate up to about forty aeroplanes, according to the machine sizes, and the terminal building, with its administration and executive offices, customs, emigration, C.I.D. and medical departments and the South Coast Flying Club headquarters, and also its control tower. The code signal allotted to the airport by the Air Ministry (" B ") is indicated by a flashing neon beacon supplied by Electroluminations, Ltd. This beacon is of cylindrical formation, 3 ft. in diameter and 6 ft. high, and its surface is made up of twenty-four panels, twelve of which are set back and faced with 13 mm. intense red neon tubing, the whole presenting a red and black chequer-board scheme. The morse-code letter " B " is signalled continuously by the neon under flasher control, and overall remote control is provided from both the control tower and the main hangar.

At 100-yd. spacings boundary lights are located along the periphery of the aerodrome to afford a clear picture from the air of its extent and shape. To ensure safety in case of accident they are fitted with 6.6-V lamps, but to guard against one lamp failure affecting the whole of the boundary lights each lamp is supplied from its own current or isolating transformer housed underground in a special cast-iron box which forms a stable foundation for the complete unit. The inverted orange glass globe and its metal receiving cup are a weatherproof assembly, and a nipple in the stem at the base is designed to break under undue pressure to minimise the danger in the event of a collision.

The transformer primaries are all connected in series by an underground single-core ring-main cable, and remote control is provided for from both the control tower and the main hangar by Igranic push-button and contactor equipment, the contactor unit in the hangar also incorporating the push buttons. A secondary tapping transformer and a special control panel in the main hangar serve the boundary lighting system separately.

To indicate to pilots the wind direction by both day and night there is an illuminated indicator at one corner of the aerodrome. This presents a T shape in the horizontal plane, has 20-ft. cross arms, and is operated by the wind. On its upper and indicating surface are mounted forty 25-W lamps, each protected by a suitably coloured weatherproof glass. Slip-ring and brush gear in the pedestal pivot provide the necessary " free " electrical connection at that point. This equipment is supplied by its own cable laid direct from the switch room in the main hangar, and it is remotely controlled from both the control tower and the hangar in the same way as are the boundary lights.

A portable landing floodlight projector facilitates night landing and illuminates the whole of the landing area from near any one corner of the aerodrome, so that, placed with its front to the wind, pilots avoid dazzle by approaching the landing ground from the back of the projector. This equipment has three banks of " Osram Horizon " tubular lamps with three lamps in line in each of the tier-arranged reflectors. The whole is supplied at 400 V three-phase and the 9-kW overall load is balanced within the apparatus itself. Each lamp has its own reflector with ample focusing facilities, and each of the nine 1-kW, 230-V lamps has separate switching arrangements.

The whole is mounted on a chassis and is drawn round the aerodrome by a Fordson tractor. There are four supply points for it on the ground periphery, with a watertight interlocked switch and socket unit at each point. A four-core trailing cable and plug on the projector equipment completes the connection at the required point. A suitable ring-main underground cable serves all the plug points.

The whole of the airport buildings and all high buildings

The floodlighting bank for illuminating the landing area

within a mile of the aerodrome are outlined with obstruction lights in each of which an inverted ruby globe and a metal receiving cup form a weatherproof unit on a suitable mounting. The obstruction lights on the terminal building are directly switched from the control tower and those on the hangars and other places about the aerodrome are also locally controlled. Distant obstruction lights, such as those on

Lancing College to the north of the airport, have automatic local control by means of selenium-cell switching units which operate according to the natural lighting conditions. The boundary-lighting system, obstruction lights, wind-direction indicator and the landing floodlighting equipment were all supplied by the General Electric Co., Ltd.

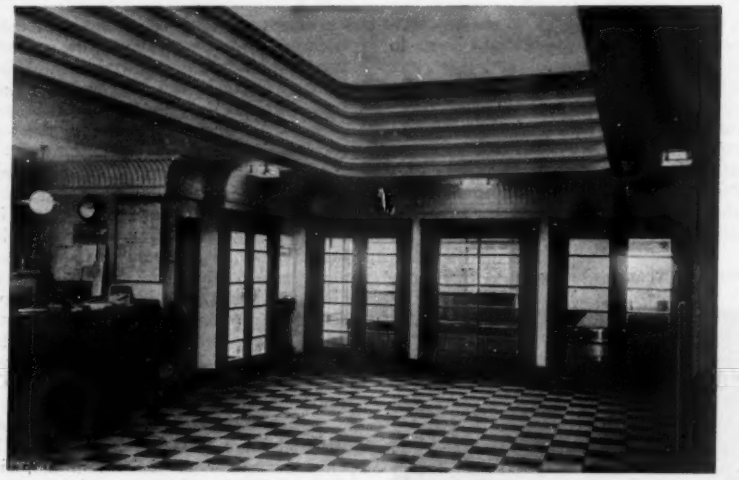
To permit working on machines in the open at night, concrete aprons immediately in front of the main hangar are floodlighted by "Duoflux" projectors, supplied by the Benjamin Electric, Ltd., fixed by special brackets to the hangar steelwork at a height of about 22 ft. and with 100 ft. spacings. Each of the three projectors is fitted with a 1,500-W lamp and has an anodised aluminium auxiliary reflector within the main heavy-gauge unit.

Mr. Tiltman spoke highly of this lighting, and said that working operations were possible at a distance of 200 ft. from the hangar. Similar fittings floodlight the forecourt on the south side of the terminal building, but in this case two fittings are bracketed on each of two "Reflector" poles at a height of about 24 ft. A large clock overlooking the aerodrome is also floodlighted. Six electrically operated petrol pumps are situated within the "flooded" area.

Inside the main hangar, a building measuring 240 ft. by 140 ft., excellent illumination at the normal working plane is provided by ten 1,000-W Benjamin industrial fittings fixed to the roof girder work at a height of about 22 ft. and with 50 ft. spacings. A few plug points around the walls inside the hangar provide power supplies for such portable equipment as electric drills and cranes, and spray painting compressors.

In the control tower Mr. Golding Barrett, the control officer, drew our attention to an "Aldis" portable hand-lamp for signalling to machines in the air and also to a "C.A.V.-Bosch" ship's signalling searchlight for signalling to machines on the ground. In use this is bracketed to one corner of the turret, outside the look-out tower, and is supplied at 20 V from a transformer on site. The smaller signalling lamp has its own self-contained 10-V wet battery which is cared for by the aerodrome battery-charging station. A radio set adapted for three wavelengths—825 m. and 862 m. for aircraft in the air and 1,186 m. for obtaining the Air Ministry's weather forecasts—is another interesting piece of the control-tower equipment. In the event of a crash, fire or other emergency the ambulance and fire-fighting staffs and others would be summoned to their stations by a "Tangent" ½-h.p. single-ended electro-motor syren supplied by Messrs. Gent & Co., Ltd.

In the terminal building we saw some excellent examples of tinted-glass lighting fittings supplied by Messrs. Best & Lloyd, Ltd. Utility is provided for generally in main lighting by totally enclosed spherical units, but in some cases, such as in the restaurant, combined utility and effect is afforded by the spheres being encircled by tinted "fins," while added colour and effect is given in other places—the bars for instance—by cylindrical enclosures with fins. The general scheme is enhanced by coloured wall fittings here and there. Concealed cornice lighting at the base of a ceiling dome over the main waiting hall is well done. A Gent electric clock system with master-clock control is installed throughout the building.



Showing the lighting in the reception hall

A central heating system is served by two duplicate oil-fired boilers equipped with motor-driven burners supplied by Kaloroil Burners, Ltd., and with Satchwell thermostat control. The main sewer by the airport is a few feet higher than the actual aerodrome level, so the site sewage is collected in a sump and pumped up into the main sewer periodically and automatically by motor-driven pumps under float-switch control. All the sewage-pumping machinery was supplied by Messrs. Tuke & Bell, Ltd.

Electricity is supplied to the airport by the Shoreham and District Electric Lighting & Power Co., Ltd., at 22 kV; it is transformed down to 400/230 three-phase on site and distributed throughout the aerodrome and buildings by ironclad distribution equipment supplied by Simplex Electric, Ltd.

The electrical consultant to Mr. Tiltman was Mr. A. Murray Coombs, M.I.E.E., and the contractors for the electrical installation work were Messrs. B. French, Ltd.

Lightweight Trolley-bus Resistances

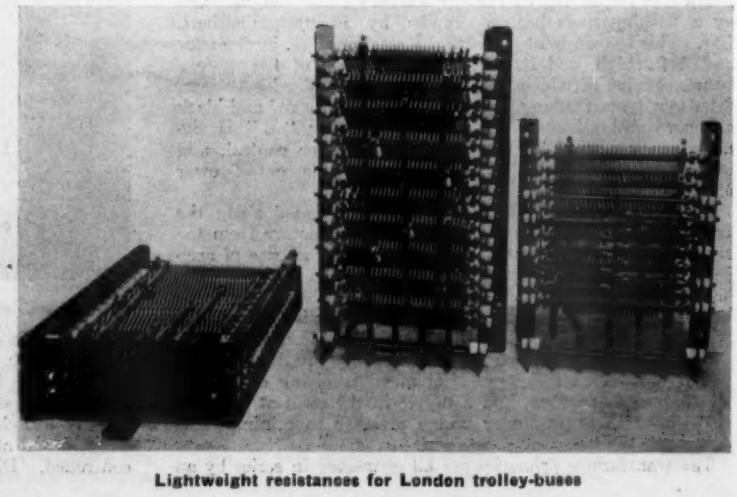
A RESISTANCE of reduced weight made by the E.M.B. Co., Ltd., is fitted to the new trolley-buses supplied to the London Passenger Transport Board. The grids are of strip material of small cross-section which offers a maximum radiating surface. The resistances are 50 per cent. of the weight of cast grids of similar rating and are also very much lighter than the original type of unbreakable rustless and jointless grids made by the E.M.B. Co.

The method of flanging the edges of the strip metal between the loops gives the rigidity required with very little support from the mounting rods when under severe vibration. The unit illustrated on the left hand side of the photograph is one of the fifty-two supplied for the A.E.C. trolley buses; the others are two of the sixty-eight units supplied for the Leyland buses. The right-hand section illustrates the small grid type resistances which have been incorporated in the same frame.

The resistances are fitted with primary insulation of steatite, mica and bakelite and secondary insulation of porcelain between the grids and frame, so that a fault from any section would not cause the frame itself to become "live." In addition to the primary and secondary insulation the resistances are assembled on dry spot insulators between the frame and chassis.

The terminal bars are mica covered and insulated from the frame with porcelain secondary insulation. B.S.S. sweating sockets are bolted direct to brass clamps, forming a very rigid and efficient contact. Rigid bare copper connections are used between the grids and the terminals.

We are informed by the company that it has recently received a further order in respect of 100 sets of this type for the London Passenger Transport Board from the English Electric Co., Ltd.



Lightweight resistances for London trolley-buses

Multiple Earthing. By T. C. Gilbert, A.M.I.E.E.

The defects of the system as a means of ensuring safety

EARTHING discussions often develop into arguments concerning the merits or demerits of multiple-earthed neutrals, which appear to be considered in some quarters as a panacea for all our earthing difficulties. Many articles have appeared in the technical Press during the last year or two, dealing with the theory of multiple earthing or describing various forms of neutral relays, all of which are essentially dependent upon the connection of the neutral lines to earth on the consumer's premises.

Apart from the fact that such connections are not yet permitted in Great Britain except in special circumstances, there is a tendency to discuss the matter purely from the theoretical angle, which may easily lead to erroneous conclusions regarding the practical value of multiple earthing. The few cases in which it has been approved in this country do not allow general deductions to be made as regards its full efficacy in other situations.

The Northampton Electric Light & Power Co. has permission to utilise multiple earthing in connection with its 11 kV ring main, and so has the Bedford Corporation with its low-voltage system through the rural area of Apsley Guise and Woburn Sands. As high voltage is used in the first case and cables in the second neither can be quoted as affecting the problem in other rural areas. The few concentric installations such as those at Haslemere, Egham, Farnham and Sevenoaks have their outers bonded to water mains (under which conditions any system would be safe) and they also have no bearing upon the real problem.

Rural Areas Considered

Earthing difficulties are being encountered mainly in connection with overhead-line supplies at low- or medium-voltage to rural areas, and this aspect only of multiple earthing will be considered. We are asked to believe that the connection of the neutral line to earth on the consumer's premises and the connection of the metal casings of all current-consuming devices to this neutral line will automatically relieve us of anxiety regarding the appearance of leakage potentials upon such casings. Elaboration of this idea by means of varying types of neutral relays will, we are told, enhance the value of such protection.

For multiple earthing to approach even remotely the value placed upon it by its advocates, as a safety measure, earthing resistances must be of a reasonably low value—not only on the consumer's premises but also at the rural sub-station. Recent investigations by such bodies as the National Physical Laboratory and the Electrical Research Association indicate the practical impossibility of securing really low values for earthing resistances in rural areas. This is confirmed by experience.

In New Zealand the great proportion of distribution is with multiple-earthed neutrals, but trouble due to inefficient earthing seems to occur with the same regularity as elsewhere. Under the heading "Is the M.E.N. System Sufficient Protection?" the *New Zealand Electrical Journal* for June, 1935, discloses the existence of a large body of New Zealand electrical opinion definitely hostile to multiple-earthed neutrals as a protection of human life; the editorial concludes with the words: "The danger does not diminish with the passage of time."

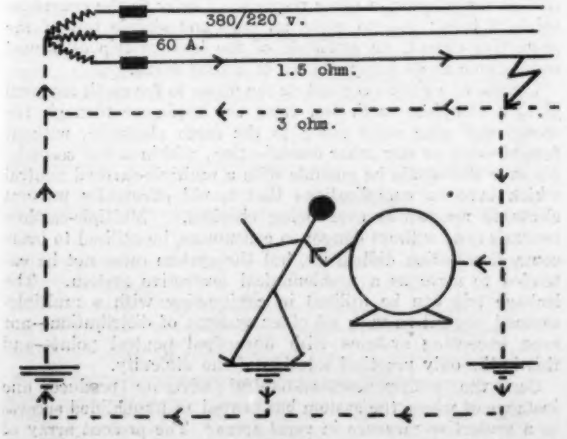


Fig. 2

In an earlier number of that journal the opinion of the engineer of the Christchurch (N.Z.) Municipal Electricity Department was quoted: "If an earthed neutral system is to be effectively earthed the idea of multiple-earthing is sound, but in actual practice the multiple earths are often quite perfunctory, and if the safety of users depended upon these multiple earths their safety would *not* be assured." The Department advocates the use of costly large-section neutrals in conjunction with multiple earthing.

To say that earths need not be perfunctory will represent an unduly optimistic view to those associated with rural development, for if there is one item in connection with which costs are grudged and chances taken it is with earthing. An engineer in charge of a large electrified rural area in this country has stated publicly that he was content to drive an earth tube into the chalk and hope for the best; few are so honest as to admit this failing, but its prevalence is widespread. The latest New Zealand wiring regulations recognise the difficulty.

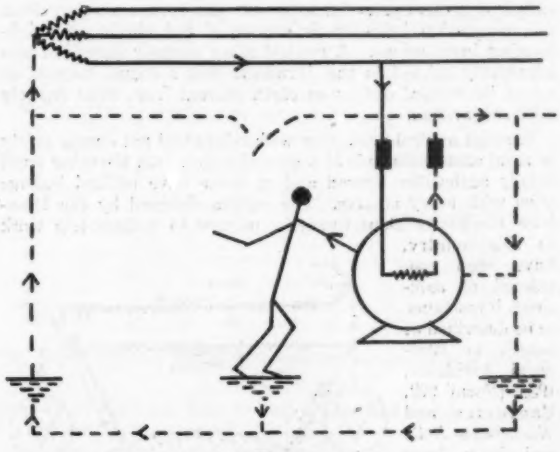


Fig. 1

and do not condemn earths unless they exceed 10 ohms—far too high a value. Engineers in that country are now becoming intensely interested in the leakage trip, indicating that multiple earthing is not all that its advocates claim.

Regarding Canada, information is not quite so easy to secure, but the Western Canada Insurance Underwriters' Association has been very worried regarding the electrocution of cattle in Alberta. The electrical consultant to that Association has solicited information concerning leakage trips, as has the city electrician of Winnipeg. Earthing resistances up to 25 ohms are permitted owing to the difficulty of securing anything lower, and this is no doubt at the root of the trouble.

Germany has utilised multiple earthed neutrals in connection with rural supplies for the past thirty years, and over 80 per cent. farms are connected—a figure approached by no other country. (ELECTRICAL REVIEW, August 30th.) Yet Germany is the home of the leakage trip; it was born and developed there, and is now *compulsorily* installed over wide areas.

Even more convincing is the case of Berlin, where presumably earthing does not present the same difficulties. Practically the whole of the electricity supply is in the hands of "Bewag." About 25,000 cookers are connected, every one of which is protected by an earth-leakage trip, this being considered the only really practical form of leakage protection. According to the "E.D.A. Bulletin," not one accident in connection with cookers has been recorded there, and this cannot be paralleled in New Zealand or elsewhere. In spite of the common use of multiple earthed neutrals which were utilised in Berlin for protection before the advent of the leakage trip, this commercial concern is willing to pay for leakage trips (8 marks small and 15 marks large) in order to secure freedom from trouble, and this in an area where multiple earthing should be effective, if anywhere.

American Experience

American experience apparently closely follows the Canadian, as an engineer concerned with the revision of the Wisconsin Electrical Code writes me—"We have been at a loss to know just how to take care of the proper installation of electrical wiring in such places as barns in rural territories; in these territories it is not possible to secure an adequate and effective ground, and the practice is to use a driven rod or pipe. Up till recently the practice has been to ground both the neutral wire of the system and also the metallic raceway or conduit to this grounding electrode. The 1931 edition of the National Electrical Code and also our present State Electrical Code require that the neutral wire and the metallic raceway or conduit shall be grounded independently to independent electrodes, unless it is possible to ground to an extensive underground

water piping system. Quite a number of cases in which cows have been killed have been called to our attention."

Put briefly, unless adequate earthing can be ensured, multiple earthing is abandoned in rural areas. During the National Convention at Bournemouth, I met Dr. Morton G. Lloyd, Chief of Safety Codes, Bureau of Standards, Washington, who was on his way to Germany to investigate at first hand earth leakage trips as installed and operated there. America, seemingly, feels the need of improved leakage protection, in spite of the prevalence of multiple earthed neutrals, and of the giving of rural supplies generally at only half the voltage of our own, but development is being hampered by the frequent accidents to cattle.

The interposition of a neutral relay will, it is claimed, eliminate most of the troubles associated with multiple-earthed neutrals, but with possibly one exception it appears that the switching-in of a considerable single-phase load would provide sufficient neutral potential to operate the device, not only upon the installation immediately concerned but also upon neighbouring installations. A neutral relay recently described was admittedly subject to the drawback that a sound installation might be tripped out by an earth current from some entirely different system.

Earthed neutral protection with relays will not ensure safety in rural areas with soils of high resistivity. On the other hand supply authorities abroad and at home have utilised leakage trips with every success. The results obtained by the Dumfries Electricity Department, a pioneer in leakage-trip work in this country, have been considered of sufficient importance to be described at length in Electrical Accidents, 1933 (Form 929, Factories and Workshops Act), and have been commented upon in these columns.

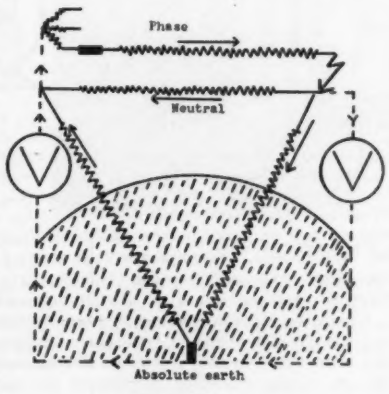


Fig. 3

In this practical survey of the position the commoner overhead line faults, such as breakage or discontinuity of the neutral line and contact between phase and neutral lines, must be taken into account.

The first essential for safety under fault conditions, accepted by engineers who have written in favour of multiple-earthed-neutral protection is good earthing conditions for the line and the installation, whereas in most cases such conditions are impracticable. Electrodes, even if of low resistance when installed, cannot be maintained in that condition with common seasonal variations, and a breakage of the neutral is likely to cause dangerous conditions in every installation in the area.

The new edition of the New Zealand Wiring Regulations, published recently, permits earthing resistances up to 10 ohms, so that 8 ohms would presumably be considered a "good" earth; safe conditions could not be secured with such high resistances, and our own regulations very wisely limit the permissible resistance to one ohm. No rural electrode can be expected to register and remain at as low a resistance as this, so that the use of a leakage trip becomes imperative.

The German engineer's reaction against dependence upon multiple-earthed neutrals as a safety measure is reflected in a book published in 1928 (and, I believe, still obtainable)—"Schutz Gegen zu Hohe Beruhrungsspannung in Niederspannungsanlagen"—at a time when the development of leakage trips in Germany was about at the same stage as it is in Great Britain to-day. A passage in this work shows the danger of handling apparatus (such as the single-phase motor shown in fig. 1) after the breakage of a neutral line, which is particularly likely where it is tapped for many connections or passes through terminals and branch boxes. In this case the unbalanced loading of the main would flow back through the transformer, *via* the two earth connections, and would cause both sides of the broken line to attain a dangerous voltage.

The V.D.E. Regulations direct that in all flexible leads the neutral should have, in addition to normal earthing, a good earth as near as possible to the end of every branch, no doubt with an eye to the possibilities indicated in fig. 1. These Regulations require neutralisation of portable single-phase apparatus to be carried out by a special lead which does not normally conduct current; the neutral lead should be of at least the same section as the corresponding conductor.

If, for instance, a motor is earthed only and not connected to the neutral lead, all other units connected to the neutral lead may attain a very high contact voltage due to the earth connection of the motor. To avoid this, the Regulations state that any form of earthing without connection to the neutral in any system in which neutralisation is used is absolutely inadmissible. If, however, some small appliance, such as an iron, is not neutralised and comes into contact with a phase conductor, every appliance that had been neutralised in the whole system would be rendered dangerous. Where this is possible either everything must be neutralised, or neutralisation entirely prohibited.

A large proportion of accidents is caused by short-circuits between the neutral line and a phase line at the end of a long supply line, as in the example taken from the work in question (fig. 2). The main supply is at 380-220 V; the phase line, 3 km. long, has a sectional area of 35 sq. mm., so that the total resistance of the copper is approximately 1.5 ohms. The neutral line is about 16 sq. mm. cross-sectional area, and will have a resistance of approximately 3 ohms. The Regulations allow a 35 sq. mm. line to be loaded up to 125 A, but assuming that for the sake of caution 60-A fuses have been provided and that the motor is connected to the earthed neutral line, then a short-circuit occurring at the end of the line between phase and neutral causes a fault current of $220/(3+1.5)=50$ A. The 60-A fuses are, therefore, not affected.

The voltage drop in the neutral line is $3\times50=150$ V, and the potential upon the casing of the motor will depend upon the earthing resistance values at the main earth and at the motor. With poor earthing conditions at the latter, the contact voltage may be the full 150 V, which is extended to all other apparatus. The German writer points out that in order at all times to keep the possible contact voltage below 42 V—the highest to which human beings must be exposed, but too high for animals—the cross-sectional area of the neutral line must greatly exceed that of the phase lines.

Strengthening the Neutral

The V.D.E. in the last Regulations issued (July, 1928), recommends that the cross-sectional areas of the lines shall be such that, in the event of a short-circuit between a neutral lead and a phase lead at least two-and-a-half times the rated current of the weakest of the protective fuses shall flow. This necessitates larger neutral lines.

Consideration of the various sources of danger attendant on the employment of multiple-earthed neutrals and of the means of protection that must be used, have driven the author of the book in question to the conclusion that the system can be economical in but few cases, for extra strong and thick neutrals must be used in order to eliminate the possibility of disconnection and high-voltage drop. He points out that the defects of the system become glaringly apparent in older installations and apparatus, especially if earlier means of protection are in use. These disadvantages have already caused several firms to place their neutral leads in such positions that they have no contact with the earthing systems. This is, in effect, to discard neutralisation.

The representative view given above is sufficient to indicate that a system that we are being urged to adopt is considered out of date in those countries where it has been the practice for a number of years. Even were neutralisation of equal value to the leakage trip in preventing danger in connection with leakage potentials, which it demonstrably is not, it would still be far inferior in other respects. I refer to the enormous value of being able to make an easy and simple test of the protective circuit, an attribute of the leakage trip of almost equal value to its independence of a good earth.

The use of a simple contact on the phase to the earth terminal gives a complete earth test from the appliance through the socket and plug right down to the earth electrode, without fuse-blowing or any other complication, within a few seconds. No such test would be possible with a multiple-earthed neutral which involves complications that would effectually prevent electrode resistances ever being checked. Multiple-earthed neutrals can, without danger to consumers, be utilised to overcome distribution difficulties, but the system must not be extended to serve as a problematical protective system. The leakage trip can be utilised in conjunction with a multiple-earthed neutral as with all other systems of distribution—not even excepting systems with unearthed neutral point—and this is the only practical solution of the difficulty.

Can the multiple-earthed-neutral advocate produce one instance of where the system has proved an unqualified success as a protective measure in rural areas? The present array of theoretical arguments remains unconvincing, and we should be ill-advised to consider the adoption of the system upon such evidence alone. The question of adequate leakage protection is still a major problem confronting the industry, especially as it affects rural areas, where, so far, evidence is forthcoming only in support of the leakage trip.

The Sliding-core Transformer.

By S. H. Hemsley, B.Sc., A.M.I.E.E.

How it differs from other types of voltage regulators

THE voltage regulators most commonly used at present are the transformer fitted with on-load tap-changing gear, the induction regulator and the moving-coil regulator. A further type, the "sliding-core transformer," introduced on the Continent, falls into the same general class as the induction regulator, in that it gives a smooth voltage variation over the whole range, but it is claimed to have advantages in operation and cost.

In its simplest form the single-phase unit (fig. 1) consists essentially of a fixed core with two sliding cores or yokes, which can be moved vertically upwards or downwards. The secondary winding W_s is wound in slots on the centre of the core K, while the primary winding is split up into two sets of coils W_1 and W_2 placed on the sliding cores, J_1 and J_2. The primary coils are connected in parallel, but they are wound so that the fluxes ϕ_1 and ϕ_2 produced in the core are in opposite directions. In the end positions the secondary winding is symmetrical with one section of the primary winding and the induced e.m.fs. are equal in magnitude to the product of the applied voltage and the turns ratio, but opposite in phase.

In these extreme positions the sliding-core transformer is similar to a normal shell-type transformer, the external primary winding being equivalent to a closed-core choke coil

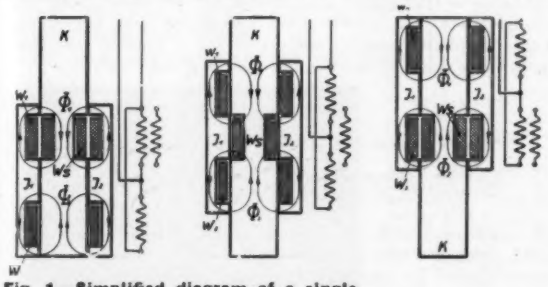


Fig. 1.—Simplified diagram of a single-phase sliding-core transformer.

connected in parallel. The secondary voltage is varied by moving the cores J_1 and J_2 upward from the first position (fig. 1), when the number of turns of the secondary winding cut by the flux ϕ_1 is gradually decreased. At the same time the number of secondary turns cut by ϕ_2 increases, until in the mean position the e.m.fs. induced by ϕ_1 and ϕ_2 are equal and opposite, and the voltage at the terminals of W_s is zero. When the mean position is passed, the voltage induced by ϕ_1 decreases still further and in the third position only the flux ϕ_2 is effective.

The terminal voltage of the secondary winding thus varies smoothly from a maximum value, through zero, to a minimum value, so that at no load the phase displacement between the primary and secondary voltage vectors is either 0 deg. or 180 deg. For a three-phase network, three single-phase limbs are assembled as a complete unit with the three sliding cores mechanically coupled together and operated by a common driving spindle. The transformer thus operates on the same fundamental principle as the induction regulator, but both the magnitude and phase of the secondary voltage vary throughout the range, while the three-phase unit is essentially different in general mechanical construction and in the straight-line motion of the "rotor" or sliding core.

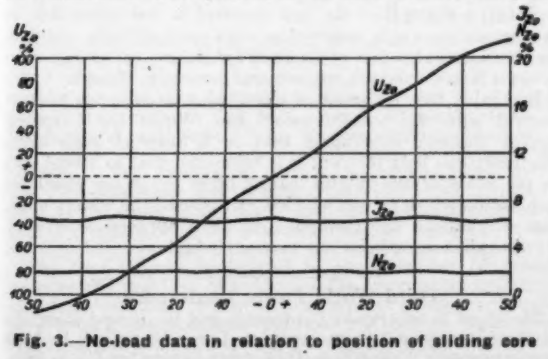


Fig. 3.—No-load data in relation to position of sliding core

The sliding-core transformer differs little in its essential parts from a normal transformer. The leakage field in the end positions is the same as that of a normal shell-type transformer, but in intermediate positions the secondary winding is displaced relatively to the primary winding, and the unbalanced ampere-turns produce a high leakage flux through the centre of the limbs. At no-load, the flux is distributed evenly through the centre portion of the limbs as in fig. 2 (i). When load is taken from the transformer a stray field is produced round the secondary coils and passes through the slots, fig. 2 (ii). This

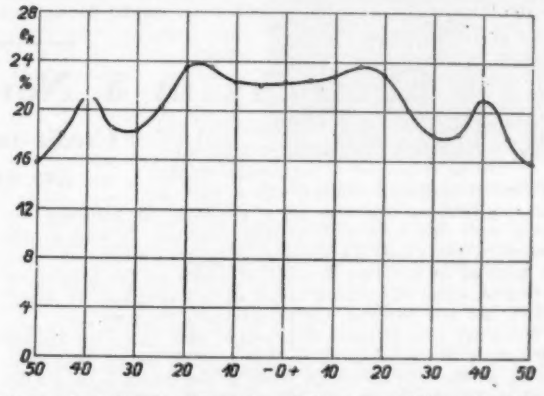


Fig. 4.—Impedance voltage in relation to position of sliding core

is added to the main flux, so that a resultant unbalanced field is produced as in fig. 2 (iii).

Leakage reactance can be limited by placing a short-circuited winding, *Sp*, fig. 2 (iv), on the middle of the core, concentric with the main windings. Compensating windings S_1 and S_2, consisting of at least two coils connected in opposition, are also added. One coil of each compensating winding is wound directly over the primary coil; the other consists of a disc coil placed in a slot on the sliding core between the short-circuited winding and primary coil. The number of turns in these windings can be chosen to give the same flux conditions as at no-load, so that a large voltage drop at the terminals of the secondary winding due to excessive reactance is avoided. The time taken to move the core from one end position to the other is from one to two minutes.

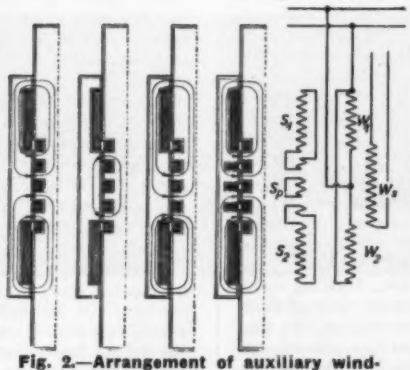


Fig. 2.—Arrangement of auxiliary windings to reduce leakage reactance

The sliding-core transformer can be used to maintain constant voltage or to vary a constant incoming voltage. When a heavy current at low voltage is required, as in electric furnace work, it is preferable to use a transformer specially designed for the work to supply the heavy current, with its primary voltage varied through a series-connected sliding-core transformer. If the primary windings of the sliding-core transformer and the furnace transformer are connected in parallel, and the secondary windings in series or in opposition, transformers with a smaller effective kVA rating can be used.

For extra high voltages it is not economical to insulate the sliding core transformer for full line voltage and connect it directly to the line. Normally the primary winding is designed for a maximum line voltage of 6,000 in small transformers and 15,000 in large units, while the secondary, or stator, winding is designed for voltages up to 6,000. Where the line voltage exceeds these values it is preferable to connect an insulating transformer in series with the sliding-core transformer, and to design the windings for any convenient low voltage. If suitable connections are chosen phase displacement of the voltage vectors is avoided. For load control between two stations, twin type transformers can be used as in the case of induction regulators.

Test Results

Tests were carried out on a three-phase unit designed to give a voltage regulation of ± 6 per cent. of a 1,670 kVA, 20 kV network. The complete unit consisted of a main sliding core transformer and two insulating transformers, connected to the primary and secondary sides of the main transformer. These results are shown graphically in fig. 3, where the voltage boost U_{zo}, the no-load current J_{zo}, and the power input

N_{20} at no-load, are plotted against the position of the sliding core. In the mean position the voltage boost is zero. Small variations in the values obtained are due to the particular distribution of slots in the core, and to the value of induction used. In fig. 4 the impedance voltage is plotted over the complete range, and it will be noted that in the end positions this value is 15.8 per cent., and in the mean position 22.2 per cent., while the maximum value is 23.7 per cent. These values are based on the kVA boost, the capacity of the transformer for different positions of the sliding core being proportional to the voltage boost.

In the accompanying table the various values are expressed as a percentage of the normal output. The efficiency of the complete unit was 89.5 per cent., calculated on the actual kVA of the transformer, or 99.4 per cent. based on the throughput kVA. The efficiency of the sliding-core transformer alone was 95.2 per cent.

		Exciting transformer.	Sliding-core transformer.	Series transformer.	Complete unit.
Normal rating ...	kVA	100	±100	100	±100
Voltage ratio at full load	Volts	20,000/380	380/±380	380/1,200	20,000/±1,200
Voltage ratio at no-load	Volts	20,000/400	380/±432	380/1,250	20,000/±1,458
No-load current ...	%	7.0	6.3	6.5	19.8
Copper loss	%	2.3	2.8	2.0	7.1
Reactance voltage ...	%	3.3	15.5	2.75	21.55
Impedance voltage...	%	4.0	15.8	3.4	22.7

Acknowledgments are due to Messrs. Koch & Sterzel, and to Dr. Ing. W. Reiche for information supplied.

Electricity in a New House.

By F. Warhurst

Credit for unwanted gas appliances

AT different times in the columns of this journal there have appeared articles referring to the cost of running all-electric or nearly all-electric houses with a view to showing that the extensive use of electricity for domestic purposes does not involve prohibitive expense. Whilst in the present writer's case the question of actual weekly cost looms as large as in any case brought to notice by the articles referred to, equal importance is laid in this article on an aspect which has not received due attention in the past.

There are a large number of people who, becoming assured by figures presented to them that a fuller use of electricity, so far as the cost of energy itself is concerned, is as readily within their means as any alternative, are still deterred from making a change by the fact that any gas appliances in service have virtually no marketable value when removed. Geysers and wash-boilers, when fitted, are generally the property of the house-owner and are left on his hands when removed from service. Whilst the hire of a gas-stove may be discontinued, a stove which was bought outright or on which the hire-purchase charges have been completed, cannot be disposed of except for a purely nominal sum, which is not a great offset to the hire or hire-purchase charges and any installation costs for the equivalent electrical appliances.

In this respect the purchaser of a new house enjoys a considerable advantage since the monetary value of any gas appliances which the builder would normally fit as standard may be realised before such appliances are installed. An unconsidered decision to employ gas in a district where electricity rates are at all reasonable constitutes a definitely retrograde step which may be regretted at a later date since the opportunity to realise on the gas appliance will then be lost. In the following notes my own experience in arranging for a new house to be equipped for the extensive use of electricity is cited as an example of the opening presented.

The house consists primarily of dining room, drawing room, kitchen, pantry and separate wash-house on the ground floor, with three bedrooms and bathroom on the first floor, the purchase price being £650. In the matter of equipment, sustained cleanliness and appearance, it was desired that the house should be just that little better than standard, but a watchful eye had to be kept on cost.

A gas geyser in the bathroom and gas boiler in the wash-house were to be supplied for water heating. The prospect of an ugly geyser in an otherwise attractively tiled bathroom was resented and alternatives considered. Systems using the dining-room fire or separate boiler were rejected on the grounds of operating disadvantages and extra initial cost.

Past experience with electric cooking had made the choice of an electric cooker automatic, and the high standard of cleanliness and appearance gave rise to a marked inclination towards the use of electricity for water heating also. After discussion with a member of the supply authority's staff it was decided to hire for use in the bathroom a 12-gal. water heater of the type arranged for wall mounting over the bath. An electric wash-boiler followed as a matter of course.

The builder was instructed to omit the geyser and boiler and asked to allow credit for their omission, which he did. The power socket included as part of the standard fittings in the kitchen was rendered unnecessary by the outlet incorporated in the cooker control switch, and credit was obtained for this item also. The figures are given below :—

	£	s.	d.
Cost of wiring and installing 12-gal. water heater ...	1	10	0
Cost of separate cold-water tap to bath ...	1	2	6
Cost of wiped joint between heater and water main		6	6
Total	2	19	0
Allowance in respect of geyser and boiler ...	5	15	0
Allowance in respect of socket in kitchen ...		10	0
	6	5	0

There was thus available a net credit balance of £3 6s. to be transferred to the "extras" account. Since the respective hire charges for the heater and wash-boiler are 7s. and 3s., the total quarterly payment for these two items is 10s. Over eighteen months will thus elapse before the above credit balance is offset by quarterly charges paid.

The household consists of two people, and at the end of the first quarter complete satisfaction is expressed with the arrangements, the convenience, cleanliness and appearance being considered ample justification for a greater cost than has actually been incurred. The cost is given below :—

	£	s.	d.
Hire of cooker		6	0
Hire of heater		7	0
Hire of boiler		3	0
Quarterly charge at 10% of rateable value per annum		10	0
	£1	6	0
Electricity consumed : 480 kWh.			
Cost at summer rate of ¼d. per kWh.	1	0	0
	£2	6	0

In connection with these figures several observations may be made, chief of which is that with the coming into force of the winter rate of ¾d. per kWh the quarterly cost will, of course, be increased. The heater was not used as an entirely automatically-controlled storage heater but was switched on when required, since tepid and cold baths outnumbered hot in the summer months. It very quickly became a habit to think sufficiently far ahead to switch the heater on in advance of a supply of hot water being required, the thermostat and lagging rendering further attention unnecessary until the water was actually drawn off. Greater use will be made of the heater in the winter months due to the higher incidence of hot baths and thus consumption on this score will increase. It may prove preferable, in view of the efficiency of the lagging, to make full use of the heater as a self-controlled unit.

A substantial increase in consumption by the cooker is not anticipated since in the quarter under review it was employed regularly for the usual daily meals (a holiday was not taken during this period) and will be subject to only slightly increased use during the winter. On a percentage basis, lighting will account for the largest increase, but here the bigger consumer has the pronounced advantage that energy for lighting is charged for at the low all-in rate as against the appreciably higher rate obtaining in the case of consumers who use electricity only for lighting and miscellaneous purposes.

Room-heating is effected by coal-fires, with an auxiliary reflector-fire inset in the tile surround of the drawing-room fireplace. With a power outlet in each reception room and two bedrooms, reflector fires may be employed in the winter as occasion demands but the cost incurred is not admissible in this article since only essential services are dealt with. It may be mentioned also that other electrical equipment in use comprises a mains radio set, an iron and a vacuum cleaner.

Inevitably any discussion of electrical costs descends to comparison with the cost of using gas. Whilst the foregoing figures illustrate once again that on a financial basis alone electricity can hold its own, it is submitted that to accept cost as the sole criterion implies that all other things are equal, an implication which no one who has experienced the convenience, ease of cleaning and continued excellent appearance of electrical appliances will for one moment admit.

Third World Power Conference

The third World Power Conference and the second Congress of the International Commission on Large Dams will be held concurrently in Washington, D.C., from September 7th to 12th, 1936, under the auspices of the American Government. The British National Committee has appointed committees to make arrangements for the preparation of papers, and copies of the full printed programme will be obtainable from the British National Committee, 36, Kingsway, W.C.2.

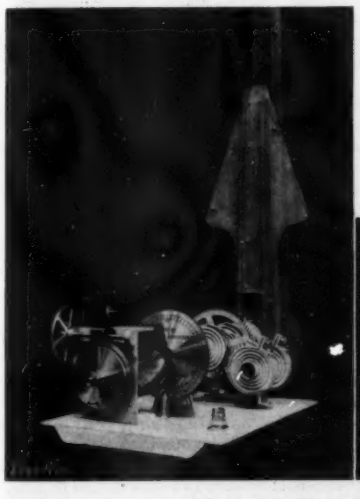
An Illuminated Town Hall Clock

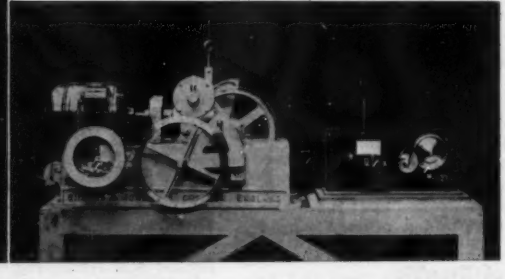
By T. R. Robinson

THE application of neon type tubing to the illumination of tower clock dials is one of the most effective methods of making them visible at night. But the fact that only very bright colours have hitherto been available has rendered the system unsuitable for the official timekeepers of some classes of building. This limitation has recently been overcome by the adoption of the very pale blue glow tubing, sometimes known as "white neon," and one of the first municipal clocks to be fitted with it is that on the tower of Stretford Town Hall, Manchester.

The four 6 ft. 6 in. skeleton dials of this clock were specially designed by the architect to harmonise with the tower, and "chapters," or bar-shaped markings, are used in place of numerals. Originally the clock hands were operated by large step-by-step mechanisms, driven by the master clock which controls the small dials inside the building. Some time after the erection the need for illumination arose, and called for alterations in the clock mechanism, the step-by-step type gear being discarded as being too light to move the heavy weight of hands carrying the tubing. The present installation employs four separate units, one for each dial, operated by synchronous motors. The first and third stages of the reduction train consist of spur gearing, the second being a worm gear. This has considerably reduced the mechanism necessary. The motors run at 200 r.p.m., and thus give a power ratio of 12,000 to 1 to the minute-hand spindle.

The method of conducting the high voltage to the tubes on the hands is a feature of the installation. The minute hand spindle is hollow, and accommodates a cable, while the hour hand is fed by a cable mounted outside its sleeve and passing through a special slot in the outer bearing and the hand itself. Connection to both cables is made by slip rings and brushes, the rings being of bronze, mounted in grooves on the rim of special porcelain insulators. The minute-hand insulator is mounted inside the 12-to-1 reduction gear necessary to drive the hour hand, while the hour insulator is fitted to the appropriate sleeve at a point midway between the gears and the hands. As an earth return is employed by way of the hands and spindles, great care was taken to space the slip rings as widely as possible from any other parts, and further to reduce the risk of leakage the sides of the insulators are grooved to lengthen the path.





Left: The dial unit showing the synchronous motor drive, slip rings and brushes. Right: The hour-striking unit and relay

The brushes making contact with the slip rings are bronze strips, and are mounted on adjustable carriers in the form of rings which encircle insulators of a similar type to those used for the slip rings. The carriers are split and thumb-nuts provide the grip on the insulators by compressing the rings. By slackening the nuts and moving the rings in a rotary direction, the brush pressure can be varied as necessary.

The Stretford Town Hall clock

Each hand is outlined with 10 mm. glow tubing, one tube being fitted to each. The chapters also each have one tube, and the 4,000 V energy is provided by groups of transformers inside the tower walls for each dial. As the dials are mounted slightly away from the tower, it has been possible to place the electrodes of the chapters behind them and out of sight. The electrodes of the hands' tubes are placed on the counterbalances and so do not interfere with visibility. On the baseplate is a carbon-filament lamp, which can be switched on to prevent condensation and to keep the lubricating oil fluid in very cold weather.

In addition to the four dials, an electrically operated hour-striking mechanism for sounding the hour on a bell weighing 10 cwt. has been placed in the tower, and provision is made for four further bells and a quarter-chiming unit to be put in at a later date. A motor drives the hammer-lifting cam by worm and worm-wheel, and spur gearing. It is started by a small contact maker, which is operated by a synchronous motor, and completes a relay circuit at the sixtieth minute of the hour. A solenoid-operated switch on the striking unit then closes the motor circuit, and at the conclusion of the striking of the hour a count wheel is arranged to return the motor switch to its original position and open the circuit mechanically. The quarter-chiming unit will be of almost identical construction. To silence the striking at night a 24-hour wheel opens the relay circuit between certain hours, preventing the operation of the motor switch.

The clock mechanism and the bell were supplied by Messrs. Gillett & Johnston, Ltd., and the tubing installation by Boro Electric Signs, the whole being erected to the instructions and under the supervision of Mr. Edwin Parker, borough engineer and surveyor.

Iron and Steel Welding

THE symposium on the welding of iron and steel, sponsored by the Iron and Steel Institute in co-operation with fifteen other scientific societies, was held in London last May. The papers and discussions have now been published by the Institute in two volumes (£2 2s.). About 150 contributions by international authorities form a comprehensive survey of the whole field of modern technique in theory and practice. The symposium makes it evident that extensive developments are possible, provided due regard is paid to the study of the many intricate problems involved in practical applications, the present limitations being due to lack of knowledge of the procedure and reactions involved.

The first volume is devoted to considerations of present practice and problems of welding in the engineering industries, and deals with such widely varying aspects as pressure vessels, shipbuilding, aeronautical, electrical and bridge engineering, and iron and steel castings. The early papers discuss applications to ship construction in Great Britain, Germany and the U.S.A., and enumerate the principal advantages. In the section on bridge engineering an important paper discusses an investigation carried out on non-destructive field tests for welded joints; X-ray, magnetic, electrical and stethoscopic methods are also considered. Mr. W. A. Stanier gives an authoritative indication of the present position of welding development on British railways. Another paper summarises the detailed test requirements of the American inspection authorities in regard to pressure vessels. The latter sections of the volume centre round the electrical welding of mild steel in plates and rolled sections, forgings and castings.

The second volume discusses the technique, metallurgy, testing and the safety aspects of welding. After a series of papers dealing with the control of welding from the electrical side, sections follow detailing methods to ensure the best weld and avoid secondary effects such as distortion and internal stresses. The Director of Naval Construction presents a valuable survey of present Admiralty practice. While the subject of distortion and internal stresses is referred to in a number of papers, it is the main theme in the contributions of Boyd and Cape and of Benson and Allison. A theoretical basis for the successful welding of thin sheet is put forward by Halbertsma, Kersten and Waddington. The latter part of this volume deals with the metallurgy of arc-welded mild steel, a résumé of the behaviour of the metal when using bare and coated rods, the welding of high-chromium iron and austenitic chromium-nickel alloys and contains a number of suggestions for necessary developments and future research.

Boiler Equipment.

By V. Walker, A.M.I.E.E.

Difficulties encountered with the various pressure parts, and suggested remedies

THE difficulties experienced in American steam practice due to poor water circulation in the upper tubes of cross-drum boilers are discussed in a report recently presented by the Prime Movers' Committee of the Edison Electric Institute. Resistance in the supply and discharge connections of the upper tube bank is sometimes high enough to cause local circulation in the tubes, with a consequent high steam-bubble volume. The middle or upper tubes in a deep bank may have little or no circulation and, being filled with a high percentage of steam volume, are often subject to over-heating and corrosion, thus necessitating their replacement and the re-expanding of leaking joints.

Corrosion results in the inside of the tube becoming coated with a deposit of magnetic iron oxide, the most severe action taking place on the upper side of the tubes about 3 to 6 ft. from where they are expanded into the uptake headers, a small transverse crack being formed on the upper side of those in the first pass. Tube deterioration is due to oxidation of the metal through reaction with the oxygen liberated by decomposition of steam in the overheated tubes, the exteriors of which are generally unaffected.

The metal temperature in the upper tubes of the second and third passes does not generally exceed 500 deg. F., but in the first pass it may be as high as 980 deg. F., at which temperature reaction takes place between hot iron and oxygen.

Ferrules have been installed in the connecting nipples between the upper and lower tube banks in order to force more water through the upper tubes; restriction plates and baffles have also been fitted inside the headers, and pipe cores inside the affected tubes.

When using pipe cores having a cross-sectional area of 75 per cent. of the tube the metal temperature does not generally exceed that of the water by more than from 20 to 30 deg. F. The provision of additional circulating tubes from the top of the uptake header to the drum and sufficient height between the top generating tube and top of the uptake header has minimised the difficulty of poor circulation.

The required steam temperature appears to be closely approached in the majority of boilers. Changes in baffling or the installation of additional heating surface have been necessary to correct low superheat in certain cases; in others the alternate first row of boiler tubes has been removed.

Compensating-type superheaters, in which more surface is located in one side of a double vertical-tube boiler than in the other and in which the gas flow is proportioned by dampers, appear to give a flat superheat curve over a wide output. The amount of slag on the furnace walls has a decided effect on the steam temperature, the minimum value being obtained immediately after the boiler has been thoroughly cleaned; the maximum (sometimes 70 deg. more) is obtained after a period of service.

Common Source of Trouble

Leakage of expanded joints in superheater headers is a common trouble, especially where the headers are within the boiler walls. Frequent re-expanding distorts the holes in the header and ruins the tubes. Special insulating cement has been applied to joints on the tube side of the headers, but this prevents examination of the exterior tube surfaces for external corrosion. Where alloy tubes are rolled into carbon steel headers leakage may be expected, because of the greater coefficient of expansion of most alloys. In one design carbon steel is resistance welded (outside the high temperature gas zone) to the ends of alloy steel tubes to provide a metal having equal expansion characteristics at the rolled joint.

Some alloy tubes are brittle at room temperatures, others at from 1,400 to 1,800 deg. F. The surface of alloy-steel tubes in radiant heat superheaters has shown considerable oxidation and scaling, as well as warping and bending which probably occur on starting up.

Boilers with radiant superheaters can be brought on to the line from cold in about two hours without the tube metal temperatures exceeding the normal operating temperature of approximately 1,100 deg. F. De-superheating sprays are employed in the headers to control the steam temperature until the boiler is on the line.

Tubes with 4 to 6 per cent. chrome and ½ per cent. molybdenum have been found superior to those of chrome-vanadium in the presence of gases at 1,800 to 2,200 deg. F., and with a steam temperature of 750 deg. F., with this type of superheater.

Alloy steel tubes containing chromium, copper and silicon are being tried where active corrosion takes place in economiser tubes caused by condensation of acid flue gases and by leaks at the joints where the tubes are expanded into the headers. Considerable leakage occurs with solid annealed copper and with double copper-jacketed asbestos hand-hole gaskets on economisers working at 1,400 lb. per sq. in., but corrugated monel metal has given good results.

Leakage at the headers has been remedied by cutting off the tubes close to them and fitting a new header on to the end of the leaking tubes. The cause of these leakages is often attributed to rapid changes in temperature of the water passing through the economiser during starting up. A by-pass has therefore been installed from the economiser inlet header to one of the lower water-wall headers; no water is fed into the boiler during starting, but it is allowed to circulate from the drum, down through the economiser and up to the drum through the water walls, thereby keeping almost the same temperature in the economiser as in the drum.

Corrosion and Clogging

Failure of tubular air-preheaters is invariably due to corrosion on the gas side, one-third of the tube length being in some cases corroded progressively towards the gas outlet, the metal being reduced to the thickness of paper. Temperature differences of as much as 60 to 75 deg. F. may exist between the tube walls and the gas along the corroded sections when the unit is steaming, but when banked practically no air passes through the heater and gas and tube temperatures are almost identical. Such temperature differences are evidence of stratified flow within the tube and dew-point temperature at the metal. In order to remove the corrosion film adjacent to the tube and raise the tube temperature, a wrought-iron strip has been inserted at the end of the tubes for a distance corresponding with the corroded section, with a marked reduction in the temperature difference between the gases and tube metal.

The clogging of tubular air heaters has been overcome by washing the tubes immediately after the unit has come off load. Insulating material has been applied to the inlet end of plate-type heaters in order to eliminate low temperatures of the metal at this point and prevent initial clogging, which is cumulative, because the gas side of the metal becomes insulated and the temperature of the tube is further reduced.

Corrosion of the air-heater surface does not necessarily result from high water-vapour content, sulphur and low-exit gas temperature. If the air heater is so designed that uniform gas and air distribution is assured, the temperature of the exit gases containing large quantities of water vapour may be reduced to 225 deg. F., without danger of corrosion of the cold end of the air heater.

The lowest air-heater exit-gas temperature, before condensation of the gases, occurred on a plant burning lignite having a moisture content of 40 per cent. The heater inlet-air temperature was 80 deg. F., and the boiler load was reduced with the air flow remaining constant; with a gas exit of 200 deg. F. no condensation occurred. At 180 deg. F. water flowed from the soot hopper at the bottom of the heater, which increased so much at 165 deg. F., that it was first thought a boiler tube had failed. It was assumed that the metal temperature of the air heater tubes at the point of gas exit was the mean of the temperature of the air on the outside of the tube and the gas inside the tube or approximately 142 deg. F., the calculated dew point of the gases burning lignite being close to this figure.

Failure Through Deposited Copper

An unusual cause of furnace-tube failure occurred at one large power station having large cross-drum boilers working at 1,400 lb. per sq. in. The furnaces have vertical bare tubes covered with Bailey blocks for a height of three feet above the slag bottom. The boilers affected receive practically all the feed water returned from steam-generating evaporators, and an external swelling occurred on the outside portion of the tubes exposed to the furnace, which later extended into an extended hole. Serious corrosion took place inside the tubes in the swollen area, grape-like bunches of fine copper particles being found. Corrosion apparently commenced from a deposit of this copper, which occurred in a zone exposed to the flame at the probable point of highest furnace temperature. The source of the copper was the dezincified Admiralty tubes in the evaporators; other metals are therefore being tried.

New Photometry Section of the I.E.S.

A special section of the Illuminating Engineering Society to be devoted to photometry and allied subjects is now being formed. The opening meeting is to take place at the Westminster Technical Institute, Vincent Square, London, S.W.1, at 6.30 p.m. on January 28th.

A High-speed Oscillograph

Recording at 100 metres per second

A CATHODE-RAY oscillograph that is capable of providing a continuous record nearly 50 metres long directly on a photographic film at a speed of 100 metres per second, is described in the paper by Mr. G. A. WHIPPLE which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 19th. The outfit was specially designed and made by the Cambridge Instrument Co., Ltd., to the requirements of A. Reyrolle & Co., Ltd., for use in conjunction with Duddell-type equipment for recording phenomena occurring in each of the three phases of that company's short-circuit performance testing plant at Hebburn.

In such test circuits steep-fronted transients and oscillatory voltages having frequency components up to 50,000 cycles per second may arise. To ensure that frequencies of this order are clearly delineated successive waves should have at least 2 mm. linear separation, which necessitates the high speed of traverse mentioned above. Since the supply frequency is 50 cycles and it was necessary to record for a period of 5 cycles, *i.e.*, for a total recording time of 0.1 sec., a long record was needed.

A high-voltage, cold-cathode type of tube is used and the electron beam impinges directly on the photographic film, 125 mm. wide, in a vacuum of 5×10^{-5} mm. of mercury. The camera drum is 2 m. in circumference and is rotated at 3,000 r.p.m., recording taking place over five revolutions. With the object of separating-out the five traces the electron beam is moved across the drum by a zero-shifting device consisting of a second pair of beam-deflecting plates inserted within the cathode-ray tube. These are energised at varying potentials by a commutator geared to the camera drive, so moving the beam across the camera drum in steps, each occurring after, and having the duration of, one revolution of the drum.

With five such steps a record length of 10 m. was obtained without overlapping of the trace. Later, its length was increased to over 50 m. by impressing upon the zero-shifting plates a slow and uniform change of potential (a condenser discharging through saturated diode valves), thus sweeping the beam slowly across the film. By varying the time-constant of the discharge circuit and the speed of the drum any desired record length within reason may be obtained.

To guard the cathode-ray tube against mechanical shock it is clamped geometrically to a 7-ft. pedestal on the 1.5-ton bed-plate. The top of the oscillograph stands 8 ft. 8 in. above floor level and the total weight of the equipment is 2.75 tons.

The motive power is furnished by a 3-h.p. four-pole synchronous machine. A 6 h.p. d.c. motor is directly coupled to the a.c. machine and is used to start the equipment and when low speeds are required. The motors drive, through a duplex chain, a lay shaft extending across the bed for coupling up the second and third phase units. A simple pin clutch in the camera chain drive frees the rotor when film is being loaded.

The driving shaft passes through special glands into the camera housing through three compartments. The first is filled with a low-vapour-pressure vacuum oil. The second is maintained at a pressure of from 0.0007 to 0.001 mm. of mercury by means of a fast two-stage, oil-sealed, rotary pump. The third compartment (in which the camera runs) is continuously evacuated by a four-stage mercury-vapour diffusion pump.

The oscillograph is operated generally with beam-accelerating voltages between 30 and 50 kV and with an anode-cathode current between 0.5 and 12 mA. The removable camera section, with electrical time-base and the two means of zero-shifting in conjunction with the variable-speed motor-driven drum camera, render the equipment universal in its uses and capable of high-definition recording over all ranges from sub-audio to high radio frequencies.

The Discussion

Opening the discussion which followed the reading of the paper, Mr. R. A. WATSON-WATT said that heavy-handed physicists were terrified of thermal junctions and spinning loops. They considered the merit of the cathode-ray to be its robustness, and it also avoided the disasters that followed the overloading of thermal instruments. The oscillograph described in the paper had surpassed the original specification in almost all respects. The author's greatest difficulties must have been connected with the use of a photographic film in a vacuum. The method devised for loading and clamping the film was the author's greatest triumph in instrumental ingenuity; it could hardly be neater or more pleasing. The beam trapping device was very simple, and other impressive features included the vacuum joints and shaft gland system.

Mr. A. M. CASSIE stated that E.R.A. had developed in a different way, on account of expense, an oscillograph to do similar work. It had provided even longer records than the author's; fixed plates were used and very high "writing speeds" were possible. A frequency of two million cycles per second could be recorded.

Dr. W. WILSON said that the second oscillograph made by the author was in operation under his control (at the Witton works of the General Electric Co., Ltd.) and he could endorse all that the author had said about it. The "writing speed" of 30 miles per second could be increased to 100 m.p.s. if necessary. Sample film records (exhibited as lantern slides and illustrating the rate of short-circuit arc recovery) indicated the instrument's capabilities and superiority over the Duddell type. The zero-shifting commutator arrangement did not seem to be sufficiently accurate to make this method better than a superposed spiral, which could be made so sharp and fine as not to be confusing. To exclude distorting fields the instrument chamber was lined with steel and placed away from the testing chamber. Since it was not subject to mechanical shock, its mechanical construction had been simplified and the weight reduced.

Mr. L. GOSLAND inquired how many times the vacuum joints could be made and broken before the packing material would need to be renewed. The E.R.A. had recently obtained an oscillograph of similar type, but mounted in a van trailer for transportability. A Cambridge type of camera chamber was used with six sealed-off television-type tubes ranged circumferentially round it. They were focused through an optical system on to the camera drum, the record being later enlarged. Twelve tubes could be fitted if necessary.

A Three-phase Outfit

Mr. R. V. WHELPTON described an oscillograph which he had constructed on a similar principle to the author's, but differing in important constructional details. It was a three-phase rotating film outfit, being more compact than three separate single-phase elements, lighter, occupying less space, and was built-in to the control panel. The film drum, weighing 25 lb., could be duplicated, one being in use while the other was removed for re-loading. Vacuum joints would not be needed if the camera drum were driven by an induction motor, one half of which could be inside and the other half outside the chamber. The use of special low-capacity screened connecting cable would enable the oscillograph to be remotely placed from the testing house, and so it need not be so robustly made. The E.R.A. had employed a continuously evacuated outfit, which was taken about in a van without joint troubles resulting. By adopting single elements with glands the author had set himself too many problems.

Mr. A. K. NUTTALL said that the use of mercury-vapour instead of oil-vapour pumps when high pumping speeds were necessary surprised him. The author's beam-deflecting plates system suggested that high potentials were necessary, and that might interfere with the focusing of the beam. Prof. J. T. MACGREGOR-MORRIS admired the courage of the firm which ordered the apparatus (Messrs. A. Reyrolle & Co.) and the determination with which its makers had carried out their task. If the drum were driven at half-speed it could be rotated in air without needing great power, and so enable all the ingenious vacuum sealing devices to be dispensed with.

Stored Film

Dr. E. H. RAYNER stated that the "writing speed" and sensitivity of a film *in vacuo* did not diminish if kept in the camera ready to record lightning. He had given up "glass bottles" in favour of all-metal enclosures. How did a "shrouded magnetic field" focusing coil work? It operated very well, but he did not know how and did not think Mr. Whipple could tell him either. Prof. G. I. FINCH said that in his laboratory he used a number of mercury-vapour pumps, without traps, and two oil-vapour pumps. The former caused no difficulties, but the latter were only used when it was essential to be free from mercury vapour.

Mr. G. A. WHIPPLE, in reply, explained that in the type of apparatus described great photographic sensitivity was not of importance; the slowest film obtainable was employed. The virtue of the rotating drum was that it provided one with the whole picture, whereas that was not possible with the multiple time-base design. Large vacuum joints could be made and broken at least fifty times without deteriorating. They had chosen the types of joint employed because they felt more sure of them than they would have done with ground surfaces on that mounting, which had to withstand extreme mechanical shocks. The film-loading time was not serious when the oscillograph room could be darkened conveniently. Since the single-element outfit had been made a six-element model had been produced. The decision to enclose the camera drum in a vacuum chamber was made only after experiments with a stream-lined rotor in air.

Industrial Electric Heating in Germany

Methods and possibilities of the system

THE advantages of electric heating and the success with which it is already applied to every type of industrial service form the subject of an excellently produced booklet* compiled under the auspices of the Electricity Supply Division of the new German national economic organisation by Dipl.-Ing. Masukowitz, with the co-operation of Prof. Dr.-Ing. Knoops and German manufacturers of electric furnaces and ovens. The primary objects of the publication are to instruct industrialists in the methods and possibilities of electric heating; to emphasize the technological and economic importance of a further increase in industrial electric heating; and to provide the representatives of supply authorities and furnace manufacturers with useful data and examples of industrial installation.

Included among the applications considered are high-temperature melting, reduction and electrolytic furnaces, welding, heat-treatment, type-casting, enamelling, firing ceramics, crematoria and steam generators. All the main types of electric heating equipment are illustrated and their distinctive features explained. Photographs, drawings and performance records of fuel-fired furnaces demonstrate the superiority of the electrical method, and as one of the instances of economical upkeep the nichrome heating element and refractory of an annealing furnace are shown still in first-class condition after seven years at up to 1,652 deg. F. All the applications discussed are illustrated from practice, and as an indication of the vigour with which the campaign is being conducted it is interesting to notice that the first printing of this publication is 10,000 copies.

In a preliminary analysis of the development of industrial electric heating in Germany the authors point out that it is now about thirty years since the first practical arc furnaces were constructed, and that the subsequent development of industrial electric heating may be divided into four main periods, viz.: (1) 1900-1920, mainly arc furnaces for the manufacture of carbide, aluminium and steel, each loaded at from 1,000 kW upwards and requiring very cheap energy; (2) 1914-1930, mainly induction furnaces, requiring from 20 to 3,000 kW each and using energy at from 1.2 to 0.36d. per kWh.; (3) 1928-1935, mainly resistance furnaces of from 10 to 1,000 kW; and (4) since 1933, development of resistance furnaces and heating elements of from 0.1 to 500 kW, by more than 100 manufacturers using energy at from 1d. to 0.36d. per kWh, this development being due largely to the activities of supply authorities in convincing industrialists of the advantages of electric heating. There is room for yet further development in the use of small heating elements in various machines and baths.

TABLE 1.

INDUSTRIAL ELECTRIC FURNACES AND OVENS IN GERMANY.

Type.	Number.	Connected kW.
Arc furnaces and reduction furnaces	160	280,000
Induction furnaces, low and high frequency ...	250	45,000
Resistance furnaces and ovens :—		
Melting	330	11,000
Hardening	390	13,000
Muffles	1,500	34,000
Annealing	110	11,000
Draw-through	45	3,000
Enamelling	40	2,500
Drying	450	7,000
Miscellaneous small	14,000	28,500
Total	17,275	435,000

The number and connected load of industrial furnaces and ovens in Germany on January 1st, 1935, were approximately as shown in table 1. Independent returns on a broader basis of classification give the values shown in table 2 for the connected load and annual load factor.

TABLE 2.

ANOTHER CLASSIFICATION OF GERMAN FURNACES.

	Total kW.	Million kWh. per annum.	Annual load factor, per cent.
Large furnaces	292,500	2,138.0	83.4
Steel melting furnaces	62,200	184.5	33.9
Other furnaces and ovens	108,300	283.5	29.9
	463,000	2,606.0	64.2

Full use of automatic control is essential to the complete realisation of the advantages of electric heating, and the logical outcome of the ease with which temperature can be held constant at any particular level is the use of cam-operated regulators to subject the furnace charge to any desired programme of heat treatment. Graphic recorders demonstrate the identical treatment of successive batches of work and, when compared with corresponding records for fuel-fired furnaces, prove the superiority of electric heating. The resultant improvement in product and decrease in spoilage are important factors, particularly in glass annealing furnaces, the heat-treatment of tools, and other special cases. In a certain plant electric hardening reduced the cost of steel for hot press tools from £250 to £100 per month. The constancy of electric furnace conditions is such that many repetition processes can be controlled by meter and switch combinations on a kWh basis.

Economic Considerations

As regards the cost of electric heating, the authors admit frankly the lower price per gross 1,000 B.Th.U. from gas and coal. The figures are, approximately, 0.15d. for electricity at ½d. per kWh; 0.05d. for gas at 5d. per therm; and 0.009d. for coal at £1 per ton. These figures, however, relate only to the primary cost of the heat developed and the comparison is completely changed when the overall operating costs are taken into account. Owing to the low thermal capacity of the powdered kieselguhr lagging used in modern electric furnaces, the heat required to bring the latter up to working temperature in intermittent service is from one-sixth to one-tenth of that absorbed in fuel furnaces with refractory brickwork.

Thermal efficiencies up to 90 per cent. or higher are obtained in electric furnaces, compared with from 5 to 30 per cent. where fuel is used. Further substantial savings are effected by electric furnaces in labour costs, space rental, cost of furnace upkeep and reduced spoilage of work. The deadweight of the work-carrying supports in an electric furnace for annealing pipes is about 15 per cent. of that of the pipes, but in a fuel-heated furnace much more substantial supports would be required, usually weighing more than the charge to be heat-treated. The avoidance of loss of metal by the use of induction furnaces compared with coke-fired crucible furnaces is often a more important consideration than the whole cost of heating. Where tools and other expensive products are concerned, the reduction in spoilage is of predominant importance. In many instances it is possible to adjust furnace ratings and periods of operation (table 3), so that the whole electrical supply to the works can be obtained at substantially lower rates.

TABLE 3.

EFFECT OF 100-kW MELTING FURNACE ON DEMAND AND LOAD FACTOR.

	Works Load without melting furnace.	(A) Total Load with melting furnace in continuous use.	(B) Total Load with melting furnace used only from 6.30 p.m. to 6.30 a.m.	
			(i) Based on actual m.d.	(ii) Based on day m.d.
Annual kWh.	262,500	826,500	781,500	781,500
Max. demand, kW.	90	190	184	90
Annual hours of utilisation of maximum demand	2,915	4,350	4,260	8,680
Load factor, per cent.	33.2	49.5	48.6	99
Night kWh. per cent. of the total	12.3	38.1	70.8	70.8

In the present highly developed state of the electric furnace manufacturing industry in Germany, considerable importance is attached to export markets and the resulting benefit to national trade balance. Apart, however, from the benefits to users themselves, the most important aspect of industrial electrical heating is its effect in improving the load factor of central stations. The annual hours of utilisation of German central station generating capacity were 2,230 in 1928 (load factor 25.4 per cent.) and 2,010 in 1934 (load factor 22.9 per cent.), but the load factor of many electric furnaces is much higher—rising to 100 per cent. in tunnel kilns for ceramics—and in general the addition of electric heating load always improves the station load factor.

The effect of resistance-type furnaces and ovens in improving the average power factor is also an important consideration. The data in table 2 relate to an aluminium works without and with an electric melting furnace and, in the latter case, with the melting furnace operating (a) continuously through the 24 hours, (b) during the night only, from 6.30 p.m. to 6.30 a.m. If the maximum demand for tariff purposes is taken from the day load curve the annual hours of utilisation in case (b) (ii) are about 8,680, corresponding to 99 per cent. load factor on the day demand. The actual figures vary with individual circumstances but this example shows the importance, to supplier and consumer alike, of adding as much heating as possible to the other electric load and transferring the heating demand as far as practicable to off-peak hours without, however, sacrificing the efficiency of working in other respects.

* *Industrielle Elektrowärme—I.* Masukowitz and Knoops. Pp. 64; figs. 99. Berlin. Arbeitsgemeinschaft zur Förderung der Elektrowirtschaft. Price not stated.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Motor Car Voltages

If a definite minimum number of contacts is necessary in either a 6- or 12-V circuit the contact resistance in series is the same for both, and the IR contact drop is less at the higher voltage due to the smaller current, and this also represents a smaller percentage of the whole.

It is my experience that batteries fail due to overcharging, at least this is the initial damage, although they finally fail through loss of capacity due to sulphation caused by loosened paste collecting in the bottom of the cell and causing an internal short circuit.

Lamps, I find, fail chiefly through damage by excessive voltage which occurs after a period of overcharging on long runs or with a sulphated battery. They rapidly become blackened and are soon broken by vibration. The 6-V lamp of thicker filament will have more metal to deposit on the glass before it becomes thin enough to break, but the remedy is not thick filaments but voltage control.

The most important difference between the two systems is in the difficulty of producing a 6-V dynamo or starter as efficient as a 12-V machine. This is also a question of contact voltage drop which, within working limits, between positive and negative brushes on a copper surface is in the region of 1.8 V when using the usual carbon brush of high graphitic content, resulting in a continuous loss of 30 per cent. with the 6-V set. This loss is reduced in the starter by using copper-carbon brushes, but it is still comparatively high.

F. G. G. STANTON.

Streetly, near Birmingham, *December 18th.*

The Ironmongers' Claim

I have read the leading article bearing this title in your issue of December 13th with considerable interest: an interest heightened by the fact that you seem to have executed a right-about-turn for no particular reason. Not so many weeks ago you were chiding the E.C.A. for obstructing the application of the Electrical Section of the Ironmongers' Federated Association for membership of the Fair Trading Council; and I particularly remember that at the time you asked the E.C.A. to remember that it was an *Electrical* Fair Trading Council.

Nothing has happened since then to change the circumstances of our application. The Council is still the Electrical Fair Trading Council; we ironmongers with electrical interests offer our help in cleaning up the trade, and the motive behind the refusal of this offer is, in the opinion of a good many people characteristic of the narrowness of outlook which is about the only thing many of the electrical trade organisations have in common.

We are entitled to resent your suggestion that ironmongers have not heard the "sad story of Committee D" and of the E.C.A. work against municipal competition, and the further suggestion that we are novices in the fight against the municipal trading bogy. We have been fighting it for years, and, not always unsuccessfully. At the conference of the I.F.A. in 1910, Mr. J. Heathcote Meakin read a paper on Municipal Trading, and the resolution with which he prefaced his paper was as follows:—

> "In view of the alarming increase in trading by municipalities and local governing bodies, to the detriment of the ratepayers' trading community, the Ironmongers' Federated Association (Incorporated) in conference assembled respectfully requests H.M. Government to take this matter into urgent consideration, with a view to the redress of the already existing anomalies, and the prevention of their increase."

A further extract from the report of that year, 1910, reads as follows:—

> "Together with the Electrical Contractor's Association, we were enabled to get clause 16 (which was detrimental to the private trader) entirely deleted from the Bill. Had no Associations existed in connection with the trades interested, the Bill would have passed through as originally drafted, and this would have been a severe blow to our members engaged in electrical work."

It should be remembered that ironmongers have had to fight municipal trading in other matters besides electrical goods, and it is foolish for the E.C.A. or anyone else to claim that they have been the only people to protest. The Birmingham and Midland Branch of the Ironmongers' Federation has been in constant negotiation with the Birmingham City Council upon the matter, and the minute books of all branches for past years will testify to the efforts which have been made by ironmongers to prevent an increase of this unfair form of trading.

I have stated in public upon many occasions that there are too many people engaged in making their pitifully small protests, and have called for an amalgamation of all the interests concerned to lodge a substantial petition to the Government. Refer to my paper to the I.F.A. conference at Blackpool in May last, in which I use the following words:—

> "It is suggested that the necessary evidence be procured and presented to the Associated Chambers of Commerce, with a view to approaching the Association of Municipal Corporations, asking for co-operation upon the grounds of public policy. A national committee should be formed with representation from the principal industries affected by municipal trading."

I have evidence that we should have the support of Members of Parliament providing the petition was presented with courage and determination, and backed by the thousands of traders suffering from one form or another of municipal trading.

You write in your article of "dissipating energies which should be concentrated upon the solution of difficult problems."

This picture (sent by Messrs. F. J. Gordon & Co., Ltd.) shows an all-steel house which is entirely electrically welded, a Hobart portable welding set being employed in the work

I suggest to you, Sir, that the E.C.A. has dissipated in our direction during the last few months a good deal of energy which could well have been better expended. We were, and still are, prepared to help with the work of the Fair Trading Council; and if unity and unanimity are so all-important, why is our proffered aid rejected? We think we know the answer to that.

How sincere the E.C.A. is in its pious cry of "Unity" is shown by the fact that it is starting a section of its own for E.C.A. members doing wireless business. On its own showing in this case the E.C.A. ought to recommend such members to join the Wireless Retailers' Association. The parallel is interesting enough, I think, for an explanation to be issued.

Cradley, Staffs, *December 17th.* E. B. HOLLOWAY,
Hon. Sec.
The Ironmongers' Federated Association (Inc.),
(Electrical Section).

Long-lived Dynamos

With reference to the note on page 828 of your December 13th issue, about the supposed oldest dynamo in regular use at Sulham Rectory, near Pangbourne, Berks, when I was at the Lizard lighthouse two years ago I was informed that the main dynamo was 56 years old and the stand-by dynamo 62 years, making them now 58 and 64 years old respectively.

Bournemouth, *December 16th.* PETER T. A. JONES.

On page 828 of your issue of December 13th you refer to a dynamo still operating at Sulham, Berks. Another very old dynamo is still in operation in this district, although unfortunately no definite date of manufacture is available. It is installed at the home of Mr. W. R. Snow, Croft House, Wallingford, Berks, and is still going strong.

This machine has been in its present owner's possession for over 40 years, and is locally believed to have been purchased by an earlier owner from Cromptons. The present owner

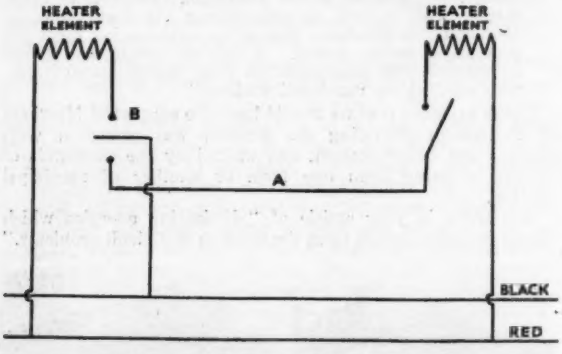
fitted modern brush gear about nine years ago. It is a 50-V machine with an output of 14 A.

THE WESSEX ELECTRICITY COMPANY.
F. T. Bushroyd,
Wallingford, *December 17th.* *District Engineer.*

Water Heaters and Load Factor

The following method of increasing the load factor of storage water heaters, which has, I believe, never been tested, has the advantage of being simple and inexpensive to install, though its field of application is likely to be limited.

Briefly it consists of so arranging two adjacent storage heaters that while one is in operation the other is out of circuit. By adjacent heaters I mean heaters installed in a block



of flats or semi-detached houses where the distance between them is only a matter of a few yards. The accompanying diagram is self-explanatory and the apparatus required is all practically standard. The single connecting cable between the two heaters is marked A in the diagram. The thermostat B has two contacts instead of the more usual one.

In deciding which consumer shall have the thermostat, preference should be given to the larger user of hot water. One advantage of this scheme would be to induce consumers to persuade their neighbours to install electric water heaters. The idea is similar to the Post Office party-line telephones. It would be necessary for the supply authority to offer some inducement such as reduced rentals or special rates for electricity consumed. With such a scheme it might be possible to waive the rental altogether.

A number of points require further investigation. For instance, the question of loading is greatly influenced by this scheme. In the larger type of house, or where two water heaters are installed, there would be a definite advantage if the two heaters were connected together as described, as the following figures taken from a typical example of a house having a 12- and 1½-gal. heater installed show.

The loading of the heaters was 1,000 W and 500 W and the total consumption for the year 3,000 kWh. Thus, the individual load factor of the two heaters could be increased from a possible 22 per cent. to 34 per cent. The 3,000 kWh taken as an example is a low consumption, and, in practice, far greater advantages should be obtained. Where the heaters are in the same premises the wire A can be incorporated as a third wire to the control heater.

Ewell, *December 17th.* J. RUSSELL HICKMOTT.

Connectors for Portable Apparatus

When tough rubber is used satisfactorily for so many purposes, why are steel springs still provided to protect the flexible cable at the entry to the terminals of kettles and other portable appliances? This question was raised by a coroner at a recent inquest, and however much those in the electrical industry may sometimes resent uninformed criticism of their work, a practical hint can now and then be obtained from someone with common sense who approaches a problem from a new angle.

The victim in the case in question had attempted to adjust the prongs of an iron with a pair of scissors without first switching off the current. Apparently at the same time she grasped the steel spring which was making contact with the other pole, thus getting a shock from hand to hand.

December 23rd. FEMINA.

Do We Compete with Gas? By "Salesman"

The shortcomings of the "standard" lighting installation

ON paper, yes, but in actual practice the yes becomes much fainter. However much we may choose to ignore it, the gas people, so far as domestic installations are concerned, are gradually cutting down the number of our more common talking or selling points. The controlling of gas-lighting points from a wall switch is becoming common; fires, too, are now automatically lighted on operating the tap. True, a small dry cell is necessary for these functions, but matches are rendered unnecessary. Moreover, the fires themselves are being produced mounted in a neat tiled surround, ready for building up to a small flue by the builder, at £3 3s. or less. Modern gas cooking stoves are equal in finish to any electric cooker, and, as every salesman knows, the finish of an article is of primary importance when selling to ladies.

Cheap hot water can be produced by gas anywhere at any time. Electricity, to compete, must be supplied at special low rates, usually involving time switching to qualify for the low rate, and systems must be thoroughly lagged to cut down heat losses. Our pet answer when confronted with the objection that electricity is dear has been: "Use enough, and under our all-in or two-part tariff we will supply you with a cheap unit." Until quite recently the gas people have been debarred from making such offers as we know them, but they are now empowered to do so, and one can rest assured that they will spare no effort to make attractive offers.

Lighting, we like to think, is practically our own happy hunting ground, but actually, if every contractor and salesman told the truth, we dare not sell enough electric light owing to the running cost. The usual 60-W lamp in an average-sized dwelling-house living room does not give enough light. If the occupier has never had gas lighting in the room he, perhaps, is unaware of the fact; but, nevertheless, a sense of some shortcoming is often present, and people whose eyesight has lost the keenness of youth frequently complain. The reason is clear. In ninety-nine out of every hundred cases the wiring contractor slavishly follows the gas practice of placing the lighting point in the centre of the room, overlooking the fact that the standard inverted gas mantle in a like position emits practically double the c.p. of the usual 60-W lamp, especially with the voltage tolerance allowed.

Fitting a 75-W or 100-W lamp is no remedy, as the user has no choice, but must run a heavy current consuming lamp all the time. Advantage should be taken of the much-vaunted flexibility of electricity, and either a two-lamp pendant fitted, or, better still, two separate points, one near the fireplace, where a lot of reading is done, and the other over the table; 40-W lamps could be fitted, and each, of course, controlled by its own switch. It can be left to the thriftiness of small consumers to operate the switches in the most advantageous manner.

The extra cost of fitting, say, two rooms per house with two-point lighting should not be excessive, and most would-be consumers are agreeable if the subject is properly unfolded and explained to them. The same argument applies to two-way switching control—a splendid selling point—but still handled as though it were gold. Surely it is time the average contractor got away from the idea of basing his quotations on the ancient system of so much per point.

Control from several points, leading to free and yet economical usage, is a big factor in the selling of electric lighting. Yet every day one meets examples of poor installations due to the ignoring of the above factor. As an instance, a supply has recently been made available in my district to a considerable number of good-class stone-built houses, pre-war value about £700, being in the majority of cases owner-occupied, and having three large rooms downstairs, cellar, and three bedrooms, bathroom and w.c. upstairs.

A standard job has been put in, comprising one central point in each room downstairs, no light in the cellar, no two-way switching in the middle room, and one light in each bedroom near the window, controlled solely by a pear switch over the bed. Consequently, on going into the dark room the unfortunate user falls over everything available before finding the one and only switch, if it has not been dropped at the back of the bed-head during cleaning operations. To crown it all, several people have retained two or three gas points, and when they wish to settle down in the evening for reading, sewing, etc., light the gas.

Plug sockets and switches are still placed on skirting boards, simply because the wireman is too lazy to make a proper fixing on the wall, or else the contractor is too poor a salesman to sell sunk fittings.

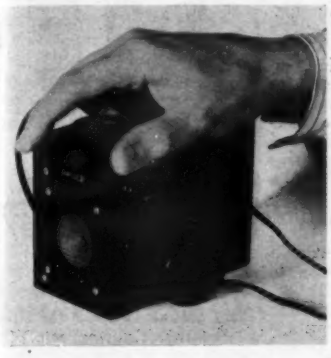
The prospective heating and cooking loads represent an enormous and still virtually untouched field, but it must never be forgotten that, in the first case, a well-planned lighting installation acts as a silent salesman.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Aid to Hearing

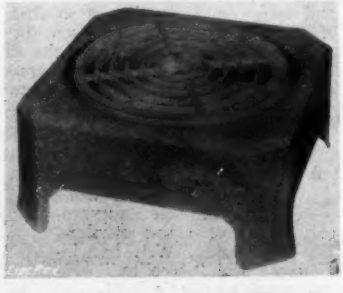
What is claimed to be the smallest valve-amplifying hearing aid yet produced (5 by 4 by 2¼ in.) has been designed by AMPLIVOX, LTD., 106, George Street, Portman Square, London, W.1. The apparatus comprises a microphone, two stages of amplification (using "midget" valves), with a 36-V battery capable of three or four months' service, and a jelly-acid accumulator giving twenty hours' use per charge. Valve amplification permits the use of a high-quality microphone giving a frequency response up to 5,000 cycles with little motional impedance, so that weak air vibrations excite motion in the diaphragm. The "Amplivox" is therefore especially suitable for those who hear with difficulty whether when attending meetings or theatres or in general conversation. Another application of the instrument is in locating faults in machinery.



The "Amplivox"

Portable Boiling Plate

An addition by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has been made to the range of "Magnet" household appliances, in the shape of a portable single-heat boiling plate with removable open coil radiant element. The plate is suitable for light duty, and is specially designed for use in bedrooms, nurseries, &c., the bright glow of the open coil element serving as a warning to children not to touch it. The plate is 7 in. in diameter and is loaded at 1,000 W, being mounted in an attractive cast-iron stand finished in "Greycoat" mottled grey porcelain enamel. Six ft. of three-core c.t.s. flexible is supplied with each boiling plate.



The "Magnet" portable boiling plate

A Hot Water Jug

The "Eddo" hot water jug is unusual in design inasmuch as the elements actually operate in the water without a sheath, and for this reason, it can only be used on an a.c. supply, as on d.c. electrolysis would take place.

The jug is made of porcelain, finished in primrose or green, and is, therefore, shockproof, while before the lid can be taken off, the connector, which is of the same type as that fitted to electric irons, must be removed. Since the elements are immersed directly in the water, there is no heat loss. The capacity is 4 pints, and the element is rated at 1 kW. The makers are MESSRS. H. G. MOSELEY & CO., LTD., Eddo Works, Hospital Street, Birmingham.

The "Eddo" hot-water jug

Malleable Pure Iron

A gas-free malleable pure iron is being introduced to the British market by MESSRS. W. EDWARDS & CO., Vaughan Road, Loughborough Junction, London, S.E.5, which is claimed to possess properties of especial value in the manufacture of vacuum tubes for electrical work. Freedom from sputtering expedites the initial evacuation of radio valves, discharge tubes, mercury switches and barretters, while the absence of gaseous and other impurities prevents deterioration during the subsequent working life. The softness and tenacity of the iron facilitates stamping and pressing, and owing to its homogeneous structure it takes a fine polish and can be easily electro-plated.

A Refrigerated Display Counter

For the attractive display of many kinds of perishable foods such as meat, fish and pastries, FRIGIDAIRE, LTD., Edgware Road, The Hyde, London, N.W.9, is now marketing an open refrigerated display counter which has been named the "Frigoplate." Its designer, Mr. J. Ingvardsen, has already carried out numerous installations of the equipment in Denmark with satisfactory results, the ability to display goods without the necessity for glass or other covering and without the fear of deterioration obviously being a great advantage.

A "Frigoplate" in a pastry-cook's shop

The temperature of the "Frigoplate" is adjusted to a constant value suitable for the type of food to be exhibited and the counter is of all-metal construction being air and watertight. In order that the chromium-plated edge of the counter shall not feel cold to the touch it is actually warmed (without any apparent detrimental effect to the operation of the apparatus) by waste heat from the compressor. Incidentally the latter can be situated in any convenient out-of-the-way position.

Any sizes of counters can be supplied and it is possible to have them arranged as shelves or built into counters, cocktail bars, &c.

Sound Recording on Glass

The electrical recording of sound on glass discs is now being employed very extensively in Holland. A few days ago we had an opportunity of witnessing a demonstration of the making and playing of a record of this type (the "Simplat") at the works of the V.G. MANUFACTURING CO., LTD., Gorst Road, Chase Estate, Park Royal, London, N.W.10, who are introducing them into this country and will start manufacture as soon as the demand is sufficient.

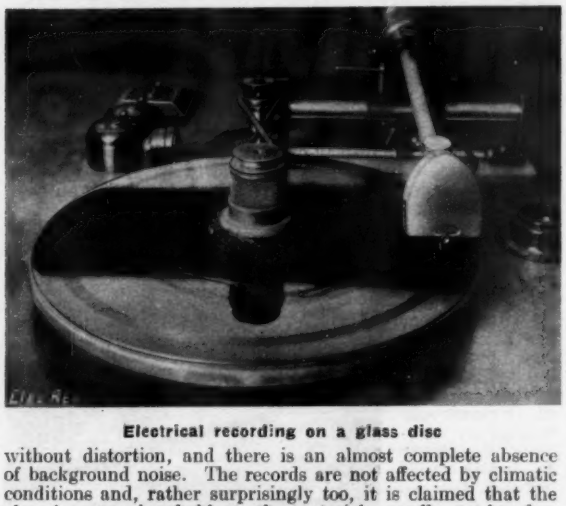
Any ordinary electrical recording apparatus may be used for cutting the disc and, though a sapphire cutter lasting about sixty records is preferable, a steel needle may be used if desired. A special non-inflammable composition on the glass receives the impression, a continuous non-sticky thread collecting round the centre stud, clear of the cutting needle.

Immediate playing back is possible without any further treatment, but should the record be required to be used more

These are two of the latest fittings to be introduced by Dernier and Hamlyn, Ltd.

than twelve times a simple hardening and polishing process taking about five minutes is desirable, this giving it a life of at least 150 runs. Viewed through a microscope the groove appears much clearer and more polished than that of an ordinary record.

Glass having scarcely any audible resonance of its own, a very wide frequency range and great volume are possible



Electrical recording on a glass disc

without distortion, and there is an almost complete absence of background noise. The records are not affected by climatic conditions and, rather surprisingly too, it is claimed that the glass is not so breakable as the materials usually employed.

Sterilising Cabinets

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne, have produced an electric sterilising cabinet with a water well at the base fitted with tubular immersion heaters. Heavy gauge galvanised steel sheeting in an angle-iron framework forms the basis of the construction, all sides and the door, as well as the top and bottom, being of double construction and lagged with 1 in. of insulating material.

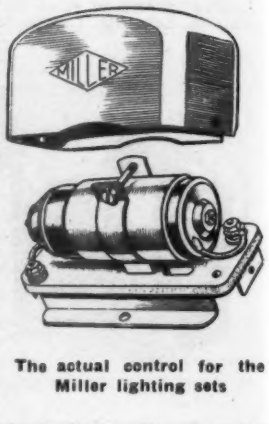
A 6 kW, 27 cu. ft. electric steriliser

Water can be fed to the heater-well from a small ball-valve tank, or manually. On the average, sterilisation is complete in less than an hour, metal utensils taking less time than bottles. There is, of course, a saving in time and electrical energy if two sterilisations can be carried out consecutively, thus eliminating the heating-up period.

Constant Voltage Accumulator Charging

At this year's Motor Cycle Show there were exhibited on certain machines a system of constant voltage accumulator charging which has been recently introduced by MESSRS. H. MILLER & CO., LTD., Aston Brook Street, Birmingham, 6, whereby the voltage generated by the specially designed dynamo is automatically controlled and maintained constant under all varying speed and load conditions.

To meet very slow running and stationary demands a battery is included in the system, but in its absence lighting is available direct from the dynamo at all normal speeds without risk of the lamp filaments fusing. Attached either to the dynamo itself, or to some convenient position on the motor-cycle, is a regulator in the form of a cylindrical cartridge having three terminals. One at the conical end is connected to the negative terminal of the system. The second, at the flat end. is connected to the dynamo positive brush. The remaining terminal (the cylindrical body of the regulator) is connected to the dynamo shunt terminal.



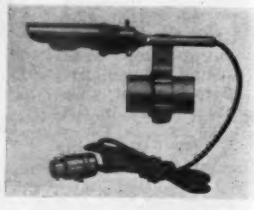
The actual control for the Miller lighting sets

The regulator functions when the dynamo-generated voltage rises above 7.3 to 7.5 V and under fully charged battery and no-load conditions a small current only flows from the dynamo through the system. Under run-down battery conditions the dynamo output increases and during day running the ammeter may indicate 5 to 6 A charge. The regulator consists of a solenoid, the exciting coil of which is permanently connected across the dynamo brushes. This solenoid actuates a plunger against the pressure of a spring. At each end of the plunger contacts are attached. When the combined dynamo speed and load conditions are such that the generated volts do not reach 7.3, the contacts remain close together so that the field resistance is short-circuited and the dynamo field is fully excited. Should the combined dynamo speed and load conditions change so that the dynamo volts reach 7.3, then the pressure between the contacts is reduced and they separate. Consequently, the shunt field circuit can only be completed through the resistance and the dynamo field excitation is reduced. Thus a vibratory effect is produced at the contacts, the closed period becoming shorter as the dynamo speed arises.

A Sewing Machine Light

To prevent eye-strain when sewing the JOHNSON ENGINEERING CO., 86, Great Portland Street, London, W.1, has introduced the "Jecolite" sewing machine needle light.

The apparatus incorporates a 15-W lamp and is sold complete with a push-bar switch, adjustable reflector, 9 ft. of flex and a combined plug and adaptor.



The "Jecolite"

Test Lamps.

By W. Pinest

THE average wireman's test lamp is, more often than not, made up of any old lampholder and two pieces of old flex. Sometimes even bell wire is pressed into service. Sooner or later, such a rig-up is sure to give trouble, due to "shorts" and earths through the poor insulation and, perhaps, defective lampholder. And the lack of stiffness in the ends of the wire makes the testing in the more inaccessible places not only unreliable but often dangerous—especially in outdoor work on 400 V. The testing of motor starters is a case in point.

The easily constructed device, shown in fig. 1, is a far superior method, and does not take up much more room in the kit. Two such detector ends wired to one or two lampholders in a small box for protection will give excellent service. The device consists of an ebonite or fibre tube about 6 in. long by ⅜ in. outside diameter and ¼ in. bore, with a piece of threaded rod nipped up at each end by a nut. In addition, the point end nut is pinned and that at the other end is arranged to take the wire connection, either by soldering or by an extra nut. The point end can then be finished by shaping to a point. A handle of either ebonite or fibre, say about 3 in. long by 1½ in. outside diameter is then bored to take the wire and opened out at one end only so as to make a tight fit on the nut and the screwed end of the tube.

In some cases, a further improvement can be obtained by fixing a bakelite lampholder, preferably of the skirted type, on one or both holders as shown in fig. 2. This adds to the portability by doing away with the lamp box, and at the same time cuts out all connections except those actually in the handle, with consequent improved reliability. A still further improvement, but limited to circuits of 250 V or less, since only one lamp can be fitted, is to fit a lampholder handle to one end as in fig. 2, and a small cartridge fuse to the other handle, as in fig. 3. One end of the fuse rests on the inner-nut fixing of the screwed rod, while the other is held by a small helical compression spring. The latter may carry the current from the fuse to the plate to which the connecting wire is soldered.

The dimensions must suit the particular brand of cartridge fuse in common local use, sufficient clearance being allowed in the bore of the handle to enable the fuse and spring to slip home easily without jamming. A type of fuse which can be rewired on the spot is preferable. Such a fuse fitting would not be called on to operate frequently, but may save a nasty splash occasionally, especially where several voltages are in common use.

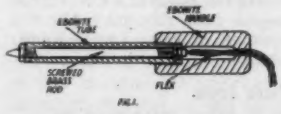


FIG.1.

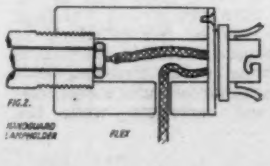


FIG.2.

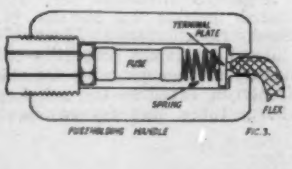


FIG.3.

Manufacturers' Activities in 1935

Metropolitan-Vickers Electrical Co., Ltd.

THE increased activity in the works of the Metropolitan-Vickers Electrical Co., Ltd., at the New Year is being more than maintained. Turbo-alternators under construction include seven of 30,000 kW and over, the largest being a 51,500-kW set for Barton B station (Manchester) with central-floor condensing plant; the alternator is to be wound for 33-kV. Three 33,000-kV, 3,090-r.p.m., two-cylinder sets for the Victoria Falls Co. are similar to the three ordered last year. Other units in hand include two of 30,000 kW for the Clyde Valley Co. and Croydon, several direct coupled sets of smaller capacity for export, self-contained geared sets ranging from 200 to 6,000 kW (Poplar B.C.), and pass-out and back-pressure turbines up to 5,000 kW.

Quite out of the ordinary is the 20,000-kW, 3,000-r.p.m., two-cylinder turbine for operating with steam conditions of 1,900 lb. per sq. in. and 930 deg. F. and exhausting at the existing boiler pressure of 200 lb. per sq. in. This machine, which is required for the reconstructed Brimsdown A station (Northmet), is, we believe, the largest built in this country for elevated temperature. The alternator is to be wound for 33-kV, as is also the 34,000-kW normal unit ordered for the same station.

Motors required for frequency change-overs include 8,800 h.p. of the pedestal-in-bracket type with sleeve bearings for mine haulage. Several drives of from 200 to 1,500 h.p. for new rolling mills are in hand, and twelve a.c. motors for winders aggregating 24,000 h.p. for Johannesburg. The new scheme of automatic increase in excitation with load for improving efficiency and pull-out torque is being applied to a number of synchronous-induction motors.

There is a big demand for large d.c. motors for iron and steel works. The largest of the several water-wheel alternators for abroad is rated at 24,000 kVA at 214 r.p.m. D.c. motors with a total capacity of 42,000 h.p. for winders and of 14,000 h.p. for rolling mills are going through the shops.

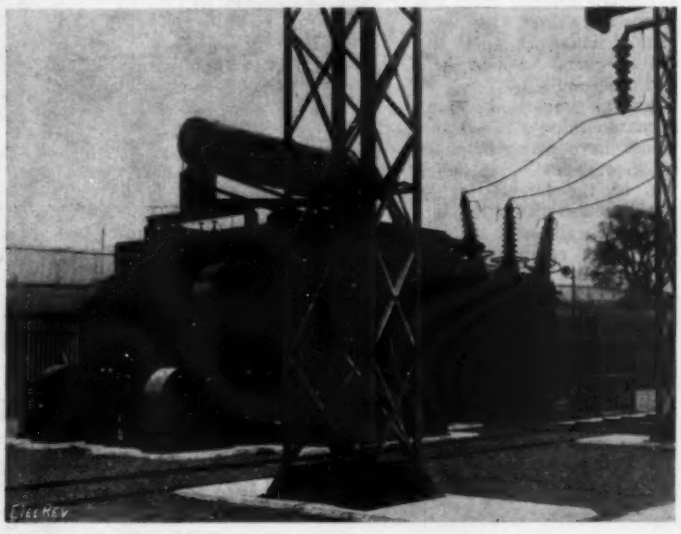
Gold mining activity has been responsible for many orders for winders from South Africa. Work is proceeding in the traction department on the comprehensive contract for the Brazilian railways, and electric tractors for the South African Railways. It is evident that regenerative control has given a new lease of life to the tramways for which many orders are in hand, as well as for trolley-buses.

In the busy rolling mill section the most interesting work in hand is the electric drive for the four-high reversing cold-strip mill destined for the Whitchurch Iron & Steel Co., which is, we believe, the first of its kind in this country.

The progress in high-frequency furnaces is reflected in the number of motor generators for units up to 20 cwt. The complete electrical equipment, including 3,500-kVA transformers, is being manufactured for two 10-ton arc furnaces which, like the h.f. furnaces, are being built by the Electric Furnace Co.

There is a considerable increase in export orders for metal-clad switchgear up to 66 kV and for outdoor equipments from 33 to 115 kV. A new pole-mounting 150,000-kVA 15-kV o.c.b. with automatic reclosing is being made. Switchgear extensions are necessitating the installation of new control boards or the modernising of old ones, both at home and abroad, including many of the miniature class with light-signal indicators.

The trend towards remote control of sub-stations is reflected in the large variety of applications being worked out. Line drop compensators for use with voltage regulators and relays for all conditions of protective service are in evidence; the "Translay" system is now being supplied for use with Scott-connected transformers. A new device is a current-operated tap changer for booster transformers which embodies bimetal strips.



A Met-Vick 45,000 kVA, 3-phase, 50-cycle, 132/33 kV, core type transformer installed at Northfleet for the C.E.B.

The largest transformers in the shops are the two of 75,000 kVA for the Fulham station, each weighing 55 tons, but the most novel type is the 20,000-kVA, 132-kV portable unit with a secondary voltage of either 11 or 3.3 kV intended as spare transformer for the Central Scotland grid. There are also two large booster transformers for Manchester for automatic on-load regulation from 6.0 to 7.5 kV and a through-power of 28,500 kVA.

The export section appears to be lively judging from the numbers of repeat orders in hand for South Africa for transformers, mainly of from 1,500 to 2,500 kVA with multiple ratio windings, and for 20,000-kW synchronous condensers. The same remark applies to distribution transformers (up to 250 kVA and 1.1 kV) for undertakings at home, for mines and for portable welders. A new d.c. welder is that known as the "Paradyne," which uses split poles and a third commutator brush for supplying the shunt field.

The research laboratories are engaged notably in investigations into magnetic steels, creep of metals, acoustics, thermionic control of welding, and clinical X-rays.

British Thomson-Houston Co., Ltd.

DURING 1935 the British Thomson-Houston Co., Ltd., has completed a 50,000-kW turbo-alternator for the Ironbridge generating station of the West Midlands Joint Electricity Authority and a 30,000-kW set for the Spondon station of the Derby and Notts Electric Power Co. Other 30,000-kW turbo-alternators were installed in the Neepsend generating station of the Sheffield Corporation and the North Wilford power station of the Nottingham Corporation, while there is in course of manufacture a 51,600-kW machine for the Kearsley power station of the Lancashire Electric Power Co. and a third 75,000-kW turbo-alternator is being made for the Barking power station of the County of London Electric Supply Co., Ltd. Outdoor metal-clad switchgear of a new design has been produced in which isolation of the oil circuit-breaker is accomplished by oil-immersed isolators in place of plugs and sockets, and an order from an important power station has been received for 33-kV switchgear of this type. Flameproof switchgear has been modernised and rural distribution switchgear has been extended by the introduction of a pull-down switch-fuse for pole-mounted transformers, which can be conveniently rewired from ground level.

There has been a further substantial increase in the output of all types of transformers, and a marked activity in connection with rectifier transformers, a new development being a portable mining type sub-station in which h.v. and l.v. flameproof switchgear is applied to a special low height mining type transformer.

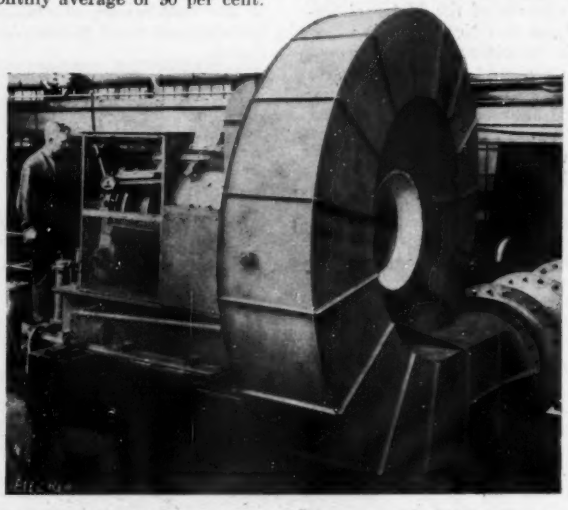
In the field of marine equipment electrical propelling machinery for the Port Jackson & Manley Steamship Co.'s double-ended passenger ferry boat *Bellubera* has been shipped to Sydney, Australia, while orders have been received for twelve direct-coupled d.c. motor-driven scavenging blowers, eight of which are believed to be larger than any yet made in this country. Turbo-generators, motors, and control gear have been manufactured for auxiliary services on several vessels.

An order for twenty mercury-arc rectifiers for use in connection with the electrification of the South African railways was received by the B.T.H. Co., through its South African representatives, Messrs. Wilson & Herd, Ltd., from the Electricity Supply Commission. The contract also includes a large number of track high-speed circuit-breakers. As regards 3,000-V rectifiers the company claims that it has now built, or

has under construction, a total number of rectifiers which is believed to exceed one-third of the world total. In connection with the change-over of frequency to 50 cycles at Messrs. Birchley's rolling mills, it was necessary to raise the power factor from 60 per cent. to a monthly average of 90 per cent. The four mills were driven without flywheels by B.T.H. induction motors having a very large overload capacity, and each now operates in conjunction with a shunt phase advancer. Another order was recently received for complete driving equipment (including gears) for a mechanised sheet mill.

Several important Ward-Leonard electric winder equipments have been completed for South Africa, including two of the largest in the world, namely, a 4,150 h.p. rock hoist and a 2,440 h.p. man hoist equipment, both for winding to a depth of 5,000 ft., for Grootvlei Proprietary Mines, Ltd.

An a.c. sectional drive has been installed in the large new extension to the Kemsley Mill of Messrs. Edward Lloyd, Ltd. The sectional drive operates on the "synchronous tie-in" system, which is new to this country. Each section motor is coupled through a belt and cone pulley drive to a "Selsyn," all the "Selsyns" being electrically connected to a common master "Selsyn."



One of eight 31,000 cu. ft. per minute scavenging blowers supplied by the B.T.H. Co. for marine service, and said to be the largest of their type ever built in this country

Two 600 h.p. and three 300 h.p. h.v. synchronous induction motors for driving rubber mills have been built with special control gear to enable quick stopping in emergency to be obtained by means of dynamic braking. This system makes the provision of expensive clutch brakes unnecessary and reduces maintenance. Numerous drivers have been supplied for excavators, while there has been a great increase in the demand for electrical equipment for the machine tool industry.

Apart from radio receivers for use in hospitals an order was obtained from the Midland Radio Relay Co. for the complete equipment for its new station at Rugby. Novel features include a volume range expander panel which compensates for restricted volume range. Special 100-W power amplifiers with low harmonic content were developed.

Much has been accomplished in the field of research, especially in regard to electric-discharge lamps, vacuum tubes and cathode-ray tubes for television, while a considerable programme of short-current rupturing capacity tests has been carried out.

New Books

A Textbook of Physics—Vol. V, Physics of the Atom. By E. GRIMSEHL. Pp. 424; illus. London: Blackie & Son, Ltd. Price 17s. 6d.

This book gives a comprehensive account of atomic physics, old and new, in which the subject is considered as a branch of experimental physics. Many books have appeared on atomic physics recently, but in practically all the emphasis has been on the mathematics, and often undue weight has been given to flaws in existing accounts of things. In this book the balance between theory and experiment inclines to the latter; a large quantity of information is given about what is known, and altogether, with its many well-chosen illustrations, it makes an excellent textbook for examination work of about pass-degree standard or general reading. The treatment is not historical.

The first chapter, on the electrical structure of matter, deals with radioactivity, the properties of α rays, cathode rays, and X rays, and certain allied topics, such as the geological aspects of radioactivity. The next chapter, a shorter one, contains more about atomic nuclei, in particular, and the facts of isotopy and nuclear structure so far as they are known; there are no details of all the very recent work on induced radioactivity, an omission which has much to commend it until the facts are sorted out better. What is practically certain is referred to.

The chapter on light and matter covers, roughly speaking, the now almost classical work on quantum physics which preceded de Broglie's epoch-making paper—the photoelectric effect, radiation from hot solids, the main facts about excitation of light by collision between electrons and atoms, and that subject which has been so much neglected in this country since Stokes's time, phosphorescence. Developments consequent on de Broglie's discovery of material waves are next taken, and the wave-properties of matter developed up to the Schrödinger model of the hydrogen atom. More complex atoms and their spectra (including X-ray spectra) are discussed, mainly on the basis of wave-mechanics and Pauli's principle, in a readily intelligible manner.

The remainder of the book is on the structure of molecules, solids and liquids, the physical basis of relativity, and, very briefly, cosmogony. It is difficult to praise this work too highly. Full, accurate and interesting, it deserves to be known and used widely.

Industrial Electronics. By F. H. GULLIKSEN and E. H. VEDDER. Pp. 245 (illus.). London: Chapman & Hall, Ltd. Price 17s. 6d. net.

The endeavour to cover in a condensed form the very rapidly expanding field of valve application in industry is a task of no inconsiderable magnitude. To reduce to a simplified form the various circuits and applications the authors have divided the book into four parts, namely, Electronic Tubes, Electronic Circuits, Electronic Instruments and Control, and Electronic Regulators. Such condensed descriptions do in some instances lack clarity, such as, for instance, that of the principle of the cathode-ray tube on page 16, which might be more happily put.

We are not in agreement with the view as to the application of electronic voltage regulators to d.c. machines on page 203. It is stated here "that it would appear doubtful that electronic voltage regulators for d.c. generators can ever be applied owing to the necessity for an a.c. supply." It is quite a simple matter to fit two slip rings with the requisite tappings to the armature to operate the voltage regulator.

Another point which is apparent is that there are singularly few references to numerous devices developed in this country to fulfil the same purposes. It is, nevertheless, an important book of ready reference for commercial and other engineers requiring the latest information on electronic tube application.

Wireless: Its Principles and Practice. By R. W. HUTCHINSON. (Third edition.) Pp. 316; figs. 224. London: University Tutorial Press, Ltd. Price 3s. 6d. net.

This edition brings up to date the information contained in the second edition, which was published two years ago. Only a few minor alterations have been made, apart from the sections on television and telecinematography, which have been extended to include material dealing with the new high definition systems.

The book deals for the most part with broadcast reception, but the general principles of transmission both by telegraphy and telephony are clearly explained. No previous knowledge of the subject is assumed, and about a third of the book is devoted to the principles of electricity and magnetism, but the fact that the reader's interest is primarily in wireless is never lost sight of. The electrical portion is, therefore, presented from the first in such a form as to lead naturally to wireless practice, and the whole is put together in that simple, lucid style which is customary with the author in his various electrical textbooks. The matter throughout is up to date and includes fundamental points in modern circuit design. Mr. Hutchinson has had long experience in teaching and knows where the beginner will have difficulty and how he can be helped to overcome it by a simple explanation of principles and a strict avoidance of detail. It is a book that can be strongly recommended for the beginner, whether he is a new student of such subjects or one who already has electrical knowledge but wishes to start a study of wireless technique.

Kurzschluss-ströme in Drehstromnetzen. By Dr.-Ing. M. WALTER. Pp. 146; figs. 107. Munich and Berlin: Verlag R. Oldenbourg. Price Rm.6.50.

This volume combines the merits of a textbook and a work of reference. In order to meet the requirements of engineers and students the author has refrained from developing new problems and hypothetical solutions; instead, he gives a well-ordered treatment of the present state of knowledge and practice, restricted to information likely to be of direct utility to the reader. Much of the information presented has hitherto been available only in scattered publications. The author's treatment is definitely quantitative, the necessary theoretical groundwork being developed very adequately and its application illustrated by numerical examples. Those who wish to go more deeply into the subject will appreciate the numerous bibliographical references, but the average engineer and student will find the author's treatment sufficient for all

ordinary purposes and a welcome addition to the literature of a.c. practice.

The outstanding merit of the book is its systematic treatment of all the main problems associated with short-circuits in three-phase networks, the various kinds of short-circuits, the partial and total resistance of short-circuit paths, the calculation of short-circuit currents, their effects and their limitation.

The treatment of initial and sustained short-circuit current values is specially useful, and so, too, is the chapter on the effects of short-circuits, which gives point to the succeeding chapters on methods of limitation and the requisite breaking power of switches. High-voltage fuses and oil-less switchgear are among the modern equipment discussed. The many examples of destruction by short-circuit afford convincing evidence of the importance of the subject.

In the Courts

THE Official Referee, Mr. C. M. Pitman, K.C., in the High Court on December 19th, gave judgment in the cross actions of the British Crystal Lamp Co., Ltd., *v.* the Northern Electrical Distributors Co., and Breed *v.* the British Crystal Lamp Co., Ltd.

In the first action the British Crystal Lamp Co. claimed to recover £103 as the balance of an account for "Fenbo" electric lamps sold and delivered to the Northern Electrical Distributors Co., Hull, who denied liability and counterclaimed for damages. It appeared that in June, 1933, the British Crystal Lamp Co. and a Mr. J. B. Breed (the plaintiff in the second action), who carried on and traded under the name of the Northern Electrical Distributors Co., entered into an agreement by which the Northern Electrical Distributors Co. was appointed sole distributor for the sale of the plaintiffs' lamps in Hull and district and to sell to Mr. Breed quantities of the lamps for the purpose of resale to the defendants' customers in the district. The agreement was to remain in force for twelve months, but was afterwards continued, and in October, 1933, as the defendants alleged, it was verbally agreed between a Mr. Epstein, acting on behalf of the plaintiff company, and Mr. Breed that the defendants should also be appointed sole distributors for the sale of the lamps in Grimsby and district, but this agreement the plaintiffs denied.

The defendants alleged that in pursuance of the agreement they had sold large quantities of the lamps during the period of the agreement and had built up a large connection of customers for the lamps in the said district. They alleged that it was a term of the contract that the lamps should be reasonably fit for the purpose of resale but that large quantities of them were defectively constructed in that the caps were not firmly attached or cemented, with the result that the customers returned the lamps and refused to deal further with the defendants for lamps. In this respect the defendants counterclaimed for £400 damages.

In reply to the counterclaim the plaintiffs denied that they were the manufacturers of the lamps (as the defendants asserted) but merely the agents for the sale of the lamps in the United Kingdom, and they also denied that defendants relied on plaintiffs' skill and judgment in the manufacture of the lamps and further denied that defendants were entitled to any damages from them.

In the second action Mr. Breed claimed from the British Crystal Lamp Co. £157 under an agreement by which he alleged that the defendant company agreed to supply him during every week covered by the agreement with lamps to the value of £20 and had failed to do so. The British Crystal Lamp Co. denied that Mr. Breed, within the period, had purchased the proper number of lamps as agreed and they in their turn counterclaimed for £298 damages.

Mr. W. A. L. Raeburn appeared as Counsel for the British Crystal Lamp Co. and Mr. Salter for the other parties in the action.

In delivering a considered judgment the Official Referee said that judgment had been previously entered for the plaintiffs in each action on the claims and he had only to try the two counterclaims. The British Crystal Lamp Co. was placing on the market an electric lamp called the "Fenbo" and Mr. Breed (trading as the Northern Electrical Distributors Co.) was appointed sole distributor for the Hull district. He was told he could expect to make a profit of £2,000 a year. He was also told that he could guarantee each lamp for 1,000 hours and replace each one that did not last that time. In 1933-4 Mr. Breed had no reason to complain of the lamps and he appointed a number of salesmen. Though he did not make any profit during the first season he had secured a number of customers and had hopes for the future. In 1934 he laid in a large stock of the lamps but then complaints began to come in and a large proportion of the lamps were faulty, the caps being loose, short-circuiting occurred, and on one occasion an explosion happened in a customer's premises. Even the lamps sent to replace the faulty ones proved, in some cases, faulty, and in these circumstances the distributing business failed altogether. He (the Official Referee) held that Mr. Breed was entitled to recover damages and he assessed the damages at £250 for which amount judgment for Mr. Breed on the counterclaim would be entered with costs.

As to the British Crystal Lamp Co.'s counterclaim, that counterclaim was based upon the fact that Mr. Breed's purchases of lamps did not come to £20 a week, the sum mentioned in the agreement. That was an "extraordinarily harsh term" to impose on a distributor, and as the company had never enforced it they could not now ask the Court to do so. Therefore that counterclaim failed and judgment would be entered for Mr. Breed with costs.

On the application of Counsel for the lamp company a stay of execution was granted on terms, with the view to an appeal by that company to the Court of Appeal.

Parliamentary News (BY OUR SPECIAL REPORTER)

IN the House of Commons on December 17th Mr. L. Smith asked the Minister of Transport whether he could state any specific cases in which the supply of electricity had been substantially cheapened as a result of the operations of the Central Electricity Board; and whether there were any cases where the price had been raised.

Captain Hudson said that there were a number of cases in which the supply of electricity had been substantially cheapened as a result of the operations of the Central Electricity Board, of which he might cite the Peterborough Corporation and the Mersey Power Co. In answer to the second part of the question, he said that the Act precluded the Board from forcing any undertaker to take a grid supply at a cost greater than that at which he could himself produce it.

Grid Tariffs

On December 19th Mr. Liddall asked the Minister of Transport whether the Central Electricity Board had fixed the grid tariffs in such a manner that, after taking into account central or overhead expenses, each area would be self-supporting, or whether the grid tariff had been fixed on the basis that some areas would subsidise other areas.

Mr. Hore-Belisha said that in the case of each of the grid tariffs at present in force the tariff had been so fixed by the Central Electricity Board that over a term of years approved by the Electricity Commissioners the receipts of the Central Board on income account were estimated to be sufficient to cover the expenditure of the Board on income account, including interest and sinking fund charges, with an appropriate margin.

A Liverpool "Underground" Proposal

Mr. Logan asked the Minister of Labour on December 19th whether it was his intention to institute work schemes for Liverpool; and would he be prepared to financially assist the Liverpool Corporation in the construction of an underground electric passenger service for that city.

Mr. Ernest Brown said that his department had no powers or funds for that purpose. The particular scheme referred to was one for consideration in the first instance by the Minister of Transport, but he was informed that it had not yet been placed before him.

Mechanical Conveyors

On December 19th, in reply to Mr. Creech Jones, the Secretary for Mines gave the percentage of the total output of coal carried by mechanical conveyors in each district in 1934, which ranged from 3.8 per cent. in the Bristol district to 82.5 per cent. in Kent. The proportion for the whole of Great Britain was 36.9 per cent.

Coal Contracts

Sir M. Manningham-Buller (C., Northampton) asked the Secretary for Mines if he was aware of the inability of certain electricity companies to obtain the supplies of coal for which they had contracted and that, in consequence, their stocks were dangerously depleted; and whether he would take steps, either by temporarily removing the quota or otherwise, to ensure that they were able to obtain the coal necessary for them to produce the current required.

Captain Crookshank said he was aware of the difficulty experienced by some electricity supply companies in obtaining supplies of coal, in particular by an undertaking in the constituency which his hon. and gallant friend represented, and he was in touch with the chairman of the undertaking on the subject. On the general question of supplies he would emphasise that the Central Council of Colliery Owners was freely issuing such allocations as were required to meet the requirements of consumers and that at last week's meeting of the Council all applications from the districts for supplementary allocations were granted in full.

The Christmas Recess

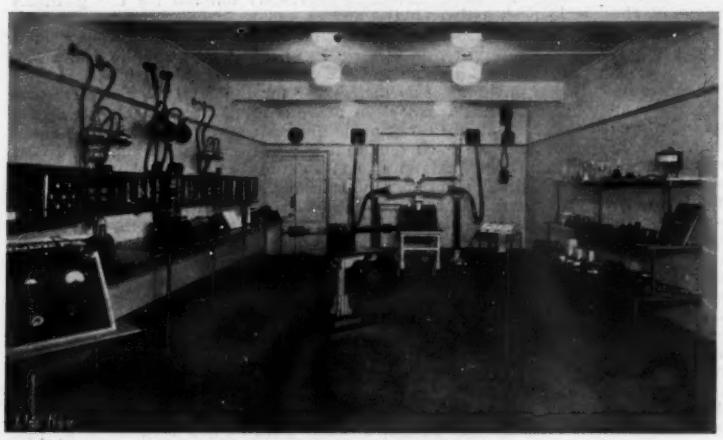
Parliament rose on December 20th and, according to present arrangements, is to meet again on February 4th.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

A Christmas Display at Eastbourne

Many novel arrangements are incorporated in the showroom displays in connection with the Christmas show of the Eastbourne Corporation Electricity Department. Part of the showroom has been transformed into an old-world garden complete with fountain. This fountain, which is operated electrically, is surrounded by a rockery with plants and flowering shrubs, and the water in the pool is constantly colour-changed by the use of under-water lighting. Other displays include a model roundabout, loaded with electrical appliances as suggestions for Christmas gifts; an autumn scene showing a selection of modern electric fires; and a Christmas tree illuminated with fairy lamps and bedecked with toys. A model of the Mall of the all-electric liner, *Empress of Britain*, is also on view.



The new Philips " Metalix " X-ray showrooms

Santa Claus is in attendance and he presents souvenirs to anyone who enters the showrooms. One of the chief attractions is the window allotted to demonstrations of sweet-making, cake-making and general Christmas fare and confection. The finished products are then placed in the showrooms for customers to sample. The other windows, too, are tastefully dressed in keeping with the season.

Japanese Orders for Germany

In the face of keen foreign competition Okura and Co., the Japanese representatives of A.E.G., are reported to have obtained an order from the Taiwan Electric Power Co., of Formosa, for the supply of two vertical generators each of 25,000 kVA, 11,000 V, and two hydro-electric turbines each of 30,000 h.p. The German company some months ago received an order from the same company for a rotary transformer of 40,000 kVA.

Cooker Control Units

A revision of British Standard Specification 438, Cooker Control Units, has been drafted in the light of experience gained in the application of the specification since its publication in 1932. The alternative arrangements now provided for have been reduced to the smallest possible number. Copies of this revised draft (CD (EL) 8457) are available from the British Standards Institution, 28, Victoria Street, London, S.W.1.

Electric Locomotives for New Zealand

In our last issue we briefly announced that the English Electric Co., Ltd., had received a contract from the New Zealand Government Railways for eight 1,340-h.p. electric locomotives. The line to be electrified is the Wellington-Paekakariki section in the North Island. The new locomotives will be used for working passenger, freight and mixed stock trains on this section. They will be of the 2-8-4 type, weighing 84 tons, with an overall length of 46 ft., and will be fitted with electro-pneumatic control. They will operate from an overhead line at 1,500 V d.c. The company claims that these will be the first British electric locomotives to adopt streamlining. Other points of engineering interest are embodied in the motor drive, ventilation and heating arrangements. The four driving motors are spring borne and transmit their power to the driving axles through flexible spring cup gear. The ingress of air to the locomotives is provided with filters so that not only the main motors which are forced ventilated, but all auxiliary motors and the control gear are provided with dust-free ventilation. Each locomotive carries an oil-fired boiler to supply the steam heat for the passenger coaches. Of the eight locomotives one will be built complete in England and the New Zealand Government Railways will build the mechanical portions of the remaining seven in its own shops, obtaining the axles, wheels, air brakes and other details from this country. The English built mechanical parts will be manufactured by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., and the electrical equipment by the English Electric Co., Ltd. This order covers the locomotives for the third section of main line electrification in New Zealand, both previous sections, *viz.*, Arthur's Pass, and Christchurch-Lyttelton in the South Island, having been equipped by the English Electric Co.

New X-ray Showrooms

Though as yet still used primarily for medical and surgical work, X-rays are finding increasing application in the industrial field and many manufacturers are already employing the rays for routine tests to ensure that their products are up to standard. The time is therefore opportune for the opening by Messrs. Philips Lamps, Ltd., of their new " Metalix " X-ray showrooms at 145, Charing Cross Road, London, W.C.2, where up-to-date apparatus for all purposes may be seen and demonstrated.

Showrooms at Skipton

The new electricity showrooms of the Skipton Urban District Council were recently formally inaugurated by Mr. M. H. Morris, chairman of the Electricity Committee, who said that the Department now had nineteen miles of cables and nine sub-stations with a capacity of 2,000 h.p., while the consumers numbered 2,500.

Orders Recently Booked

In our issue of December 6th we reported that Messrs. Yarrow & Co., Ltd., had received the contract from the Glasgow Corporation for six boilers for Dalmarnock power station. Messrs. Yarrow now inform us that the order includes the complete installation with water tube boilers, stokers, economisers, air heaters, fans, grit catchers, chimneys, coal and ash handling plant, piping, foundations, buildings, &c., and is claimed to be one of the largest boiler contracts ever placed in this country. Each boiler will be of the company's latest patent " S.F.3 " type and will generate 200,000 lb. of steam per hour at a working pressure of 625 lb. per sq. in. superheated to 850 deg. F.

The Paris Fair

The Paris International Trade Fair will be held next year from May 16th to June 2nd. By the end of October last practically all the available space in the principal sections of the Fair had been booked up again. Additional ground has been acquired, however. The exhibitors at the last Fair numbered over 8,000, representing thirty-five different countries. Intending exhibitors from this country should get into touch with the London office of the Fair at 17, Tothill Street, S.W.1, where inquiries regarding trade between the two countries are also dealt with.

Suppressing Electrical Interference

With a view to assisting wireless traders in the elimination of electrical interference both in their showrooms and in private houses when installing a radio set, Messrs. Belling & Lee, Ltd., are issuing regular bulletins on the subject. Up to the present four of these have appeared.

An Illumination Library

The formation of a library of books dealing with every aspect of illumination, photometry and kindred subjects is now being undertaken by the Illuminating Engineering Society. Certain books on these subjects are available at the chief scientific and technical libraries, but there is at present no place where all such literature is assembled together for ready reference. A fund has already been started and offers of contributions of books are being received by Mr. J. S. Dow, 32, Victoria Street, London, S.W.1.

Cables in Argentina

An interesting cable network contract with Henley Cables was carried out in the early part of this year (1935) at Comodoro Rivadavia, the most important town in the National Argentine Territory of Chubut. The town is situated at the foot of some hills coming down to the Atlantic, about 900 miles from Buenos Aires, and the surrounding country is absolutely barren. In addition to considerable lengths of 1,000-V underground armoured cable, Henley's supplied seven distribution pillars, over 500 branch boxes, fifty-eight straight-through

boxes, all necessary compound for the boxes and various incidental accessories.

A Battery Amalgamation

An amalgamation is taking place, as from January 1st next, between Alklum Storage Batteries, Ltd., Halifax, Yorks, and Ionic Alkaline Batteries, Ltd., Stratford, London, E. The result of this amalgamation will be to strengthen the resources of both companies and to improve the service to their customers and the quality of their products. The combined undertaking will in future be known as Alklum Ionic Batteries, Ltd., with head offices and works at Halifax, and London offices at Windsor House, 46, Victoria Street, S.W.1. The latter offices were opened on December 9th, and all future communications should be addressed either to Halifax or to Victoria Street. The new company will have at its disposal all the patents, processes, trade marks and staffs of the two individual companies, and will offer a complete range of "Alklum" and "Ionic" batteries for all purposes.

Kempe's Engineers' Year Book

The forty-second edition of "Kempe's Engineer's Year-Book, 1936," has just been published (Morgan Bros. (Publishers), Ltd., 31s. 6d. net). This well-known handbook, which deals with all phases of modern engineering practice, has been checked and revised and a considerable amount of new material has been added. There is a new section dealing with acoustics, vibration and noise, while important additions have also been made to the sections dealing with steam and electrical engineering. The trade descriptive sections have been extended and contain full particulars of various products of a number of engineering companies. A tribute is paid in the preface to Mr. H. R. Kempe, the founder of the handbook, who died in April last.

Employment in November

Employment in the engineering industry during November showed a slight improvement on the whole and was moderate to fair. It was fairly good in electrical engineering. As compared with a year ago, states the *Ministry of Labour Gazette*, employment was better in all sections of the engineering industry and in all administrative divisions. The number of unemployed in the industry fell by 1,820 to 101,390, the percentage being 10.5 as compared with 12.9 in November, 1934. In the electrical engineering section the number of unemployed was 5,223, or 5.6 per cent., as against 7 per cent. in November, 1934. The unemployed in the electrical wiring and contracting industry totalled 4,439, the percentage falling from 13.2 in October to 12.6, the same level as for November last year. In the electric cable, apparatus, lamps, &c., group the number of unemployed was 11,604, the percentage rising from 7.2 to 8.2 (8 per cent. in November, 1934).

A Yorkshire Quarry Electrification

One of the best known quarries in the south of Yorkshire is owned by Jas. Turner & Son, Ltd., at Kiveton Park, near Sheffield. Although handicraft holds its own in this branch of industry so far as the later stages of production are concerned, effective use is made of power operated machinery in the quarrying of the stone and subsequently in the sawing and other processes necessary to prepare the stone for the mason. Originally steam engines were employed as the motive power for driving the various tools and appliances through a very complicated system of shafting and belting, which involved heavy transmission losses. It was decided therefore to carry

A part of Messrs. Turner's stoneworking plant

out a complete power conversion scheme, and to install electric motors for the various drives, power being taken from the mains of the Yorkshire Electric Power Co. The contract for the whole of the motors and motor control gear was entrusted to the General Electric Co., Ltd. The scheme was prepared by Mr. M. S. Mason, borough electrical engineer of Worksop and the whole of the wiring and installation work was carried out by Messrs. Shaw & Sons, Worksop. For drilling at the quarry face compressed air operated drills are employed, the air supply being taken from a Broom-Wade compressor driven by a 25-h.p., 1,440-r.p.m. Witton slip-ring motor through a Bates-Vulco rope. The stone, when quarried, is first treated by stone breakers and screening plant, the motors driving these appliances being respectively of 30 h.p. and 15 h.p. capacity. The transport from stock to the machining sections is by means of a 10-ton overhead electrically driven crane. The stoneworking machinery consists of planing machines, carborundum saw, diamond saw, &c. A view of these units with the motors which drive them is given in the accompanying illustration. The 8-h.p. squirrel-cage motor driving the moulding planers is operated by a direct-to-line starter, and the slip-ring machines which drive the saws are controlled by oil-immersed rotor starters. The lime kiln has a capacity of 100 tons a week, and for hauling the coal to the furnaces an electric haulage driven by a 5-h.p. totally enclosed squirrel-cage motor is employed.

Electroflo Instruments for Holland

The accompanying illustration shows a comprehensive instrument panel supplied by Electroflo Meters Co., Ltd., for the

The instrument panel for the boiler and turbo-alternator plant in the control room of the Provinciale Electriciteitsbedrijf van Noordholland, Velsen

control room of the Provinciale Electriciteitsbedrijf van Noordholland, Velsen, as part of a contract for complete instrument equipment for the boiler and turbo-alternator plant. All measurements are made electrically including the steam flow from boilers, steam to turbo-alternators, turbo condensate, circulating water, steam and feed water temperatures and pressures, and the analysis of the products of the combustion in terms of CO_2 and $CO+H_2$.

An Exporters' Guide

The twentieth edition of the "International Mercantile Diary & Year Book" has now been published (Simpkin, Marshall, Ltd., price 10s. 6d. net), and in this edition the rearrangement started last year has been completed. Considerable additions have been made to the text, some of the sections having been entirely re-written. New features include letter telegram rates for every country in which the service exists, a facsimile of the new quota textile form, a glossary of commercial terms in six languages, and a simple interest table in decimals. The first part deals with Great Britain and the British Empire countries, the latter being arranged geographically, and the second with foreign countries, while a further guide to all the principal towns and countries in the world is afforded by the index and gazetteer. There is also a collection of useful data and information.

The New Birmingham Fire Station

The new central fire station of the Birmingham Fire Brigade has a number of electrical features of interest. A call received by telephone in the central control room is followed by the pressing of a few buttons, which give the alarm; effective lighting (inside and outside) is attained; the engine room doors open; the engine starters come into operation, and when the men are mounted on the engines instructions can be given to them by loudspeaker. There are coloured light signals throughout the premises. The heating system is electrically controlled and regulated, and the clocks are all electrically driven, while there are innumerable electrical devices attached to pumps, fans, lifts, hoists, &c. To enable this and the lighting of the whole premises to be attained has entailed the use of over forty miles of wires and cables and 60,000 ft. of steel conduit, in addition to about 1,000 lamps and their various local control. The electrical installation was carried out by Messrs. Walker Bros. (Electrical Engineers), Ltd., of Birmingham.

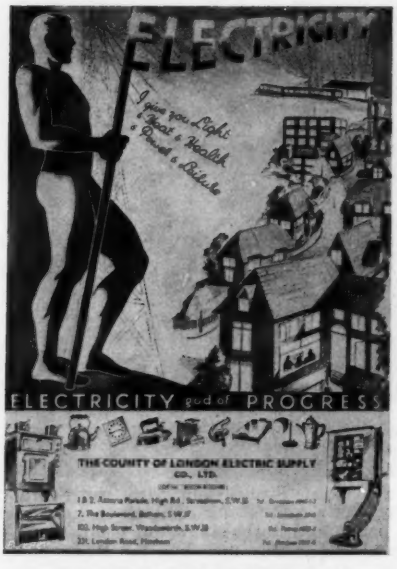
Social Events

The second dance of the "Juno" Rugby football team (Messrs. Johnson & Phillips, Ltd.), was held at Perseverance House, Charlton, London, S.E.7, on December 14th. "Juno," which is a comparatively new Rugby side, has played thirteen games this season, winning four, drawing one and scoring 121 points against 122 by opponents. During the evening Mr.

Wilfred Newland was presented with a book on the game as a memento of the work he has put in since the club's inception. The Club is anxious to fill its fixture list for 1936-7. The open dates are as follows:—September 19th, September 26th, December 12th, January 16th, February 6th, March 12th, and March 19th.

The sixth annual staff dinner of the Aron Electricity Meter, Ltd., was held last Friday at the Connaught Rooms. The attendance was a record—about seven hundred—and the speeches were brief. Among the guests were, as Mr. P. Ashley Cooper (director) pointed out in proposing their health, many customers and rivals, and even a few who were both. The response was given in lively vein by Mr. J. W. J. Townley, engineer and manager of the West Ham Electricity Department. Mr. A. White, a member of the board, proposed the toast of "The Staff," and Mr. L. Freeman, general manager, replied. Mr. H. Kahn (chairman of the company) in proposing the toast of "The Company" met with an enthusiastic reception. The dinner was followed by dancing to Jack Payne's band.

New "Clesco" Publicity


ELECTRICITY
I give you Light & Heat & Health & Power & Beauty
ELECTRICITY God of PROGRESS
THE COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.

A "Clesco" advertisement

The accompanying illustration shows a special Christmas advertisement which has been prepared by the County of London Electric Supply Co., Ltd. It will be seen that, in addition to emphasising the advantages of using electricity in the home, it draws attention to some of the many domestic electrical appliances which make suitable Christmas gifts.

Calendars and Diaries

The block calendar received from Messrs. Barrett, Tagant and Gotts, Ltd., has daily slips with bold red figures on a card which draws attention to "Maxima" lubricating oils and greases.

A charming portrait on silk entitled "Shirley" has been selected by Messrs. Christy Bros. & Co., Ltd., for their calendar.

Excellently reproduced photographs of typical Swiss scenery again make an attractive calendar sent us by British Brown-Boveri, Ltd., which has monthly sheets.

The neat pocket diary received from the Arora Co. is bound in dark green leatherette.

The 1936 calendar of Messrs. Evershed & Vignoles, Ltd., has monthly sheet on each of which is an excellent photograph of the English countryside. The calendar bears a portrait of Mr. Sydney Evershed, M.I.E.E., chairman of the company.

A dainty little maiden makes an attractive picture for the calendar of Messrs. G. E. Wallis & Sons, Ltd.

The calendar of the County of London Electric Supply Co., Ltd., has monthly sheets, each containing a humorous drawing in colour by H. M. Brock, with an appropriate electrical title.

The Hackbridge Electric Construction Co., Ltd., and the Hewittic Electric Co., Ltd., have sent us a handsome pocket wallet in black morocco leather.

From Brook Motors, Ltd., we have received an ashtray in mottled red moulded material.

The block calendar of Messrs. Lindsay & Williams has large daily slips with prominent red figures.

As in previous years, the calendar of British Insulated Cables, Ltd., has monthly sheets with smaller slips for the preceding and succeeding months and the past and following years.

Venner's Time Switches, Ltd., have adopted as a Christmas souvenir this year a British-made double-ended (black and red) refill pencil.

Messrs. Fernand Espir, Ltd., have sent us a refill for their desk calendar.

The calendar of the British Jeffrey-Diamond, Ltd., has monthly slips attached to a card bearing illustrations of its products.

Mr. Samuel Baxter's calendar has monthly slips on a card bearing a view of his works.

We desire to convey our thanks and best wishes to the large number of our readers who have sent us cards conveying the season's greetings.

New Parliamentary Bills

We publish below a list of proposals of an electrical nature that will come forward in the ensuing session of Parliament. Readers who are desirous of obtaining further information will find the notices published in the *London Gazette* for December 6th and 10th.

Liverpool and Brentford and Chiswick Corporations and Bedwellty U.D.C.—Further powers in relation to their respective electricity undertakings.

Swansea Corporation.—Powers with respect to the purchase of certain transport undertakings and to the running of public vehicles; to make provision with regard to the abandonment of the tramways and light railways; and for other purposes.

London Passenger Transport Board.—Powers to provide certain services of trolley vehicles; to construct new works; to acquire lands; to raise additional moneys; to confer further powers on the Board.

Great Grimsby Street Tramways Co.—To run trolley vehicles in the urban district of Cleethorpes and to abandon the tramway.

An Instrument Jubilee

IT was as far back as 1886 that Mr. Sydney Evershed, to whose career reference is made in our personal columns this week, joined Messrs. Goolden & Trotter as manager of premises in Westminster, in which they proposed to make Cardew voltmeters for the Navy. Goolden & Trotter, who had succeeded Edmunds & Goolden, the original firm founded in Halifax, still carried on the dynamo section of their business in that town.

In 1888, however, Mr. A. P. Trotter having retired, Mr. Llewellyn B. Atkinson joined the firm which took the name of W. T. Goolden & Co. The whole of the business was then concentrated at Woodfield works, near Westbourne Park Station, where Mr. E. B. Vignoles first met Mr. Sydney Evershed, thus starting a long association.

When a demand arose for the wiring of houses, insulation became a factor of primary importance and it occurred to Mr. Evershed that the ohmmeter devised by Professors Ayrton and Perry for measuring low resistances might be adapted as a direct reading instrument for the measurement of insulation, current being derived from a magneto generator small enough to be carried in the hand, yet capable of developing a pressure comparable with that of the supply. Thus originated the insulation testing set. In 1904 a radical change was made by the introduction of a moving coil ohmmeter which formed a single unit with its generator, so that the whole could be mounted in one case. The trade mark "Megger," was devised at the same time, and from the original have been developed the "Bridge-Megger" for the measurement of resistance by the Wheatstone method, and the "Ducter" for testing low resistances down to one microhm. Subsequent developments of the "Meg," the "Bridge-Meg," and the "Wee-Megger-Tester," embodied no new principle, but were chiefly characterised by successive reductions in weight and dimensions with a view to increasing their portability and usefulness.

In 1895 Evershed and his friends, supported by Adolph Vines, who had joined the company in 1891, purchased the goodwill of the instrument-making business from Easton, Anderson & Goolden, who had succeeded W. T. Goolden & Co. A new company was registered under the name of Evershed & Vignoles, Ltd., the co-operation of Professor E. Ayrton being secured. In 1900 freehold land was acquired for a new factory near Chiswick Park station, and in 1903 the business was moved to new premises erected on the site where it is still carried on, which now extends to over three acres.

The connection with the Admiralty was maintained, and in 1893 Evershed, in conjunction with A. E. Richards, of the Corps of Royal Naval Constructors, developed the first electrical helm indicator, and similar rudder indicators, improved in design from time to time, have been supplied to ships of H.M. Navy ever since that date. The company, in addition, manufactures a wide range of electrical measuring instruments and has specialised in distant indication and control.

Meanwhile, Mr. Evershed studied, in a long series of experiments, the characteristics of the iron used in transformers. He investigated the phenomena exhibited by insulating materials under electrical stress and obtained results of great interest, which formed the subject of a paper read before the Institution of Electrical Engineers in 1913. His study of permanent magnets, continued over many years, gave invaluable data for design where rule-of-thumb methods had been prevalent, and in later years he has devoted much thought and experiment to the constitution and properties of magnet steel with a view to the systematic production of material for permanent magnets of the highest efficiency.

Llanelly and District Electric Supply Co., Ltd., and the Nottinghamshire and Derbyshire Traction Co.—To run trolley vehicles on certain routes.

North Metropolitan Electric Power Supply Co.—To confer further powers on the company, and for other purposes.

South Wales Transport Co., Ltd.—To provide for the abandonment of the tramways and light railways in the borough of Swansea; to confer further powers on the Swansea Improvements and Tramways Co.; to ratify the assignment to the South Wales Transport Co., Ltd., of a lease of the Oystermouth Railway and the works of the Mumbles Railway and Pier Co.

Colne Valley Electric Supply Co., Ltd.—To synchronise the dates of purchase of the undertakings carried on by the company and the Northwood Electric Light & Power Co., Ltd.; to provide for those undertakings being purchasable together by the London and Home Counties J.E.A.; and to make consequential provisions with regard thereto.

Bath Corporation.—Authorising the Corporation to acquire the undertaking which comprises the Pulteney Bridge in the city, the undertaking of the Bath Electric Tramways, Ltd., and part of the undertaking of the Bath Tramways Motor Co., Ltd.; and to empower the Corporation to run public service vehicles.

Wolverhampton Corporation.—Further powers with regard to the provision and working of trolley vehicles and further provision with regard to the electricity undertaking.

Cornwall Electric Power Co.—To confer further powers on the company, and for other purposes.

North Wales Power Co., Ltd.—To authorise an increase in the capital of the company, and for other purposes.

Huddersfield Corporation.—Further powers with regard to the trolley-vehicle undertaking.

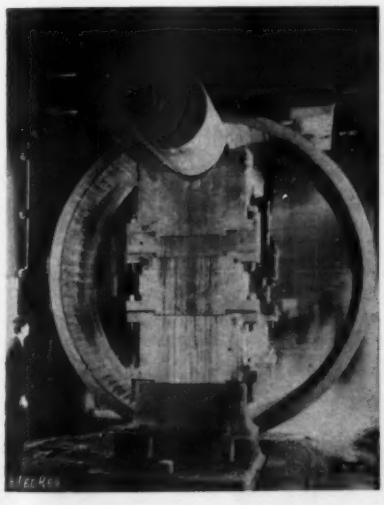
Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board.—A Bill to authorise the Board to provide and work trolley vehicles and to confer further powers with regard to the electricity undertaking.

Trade Announcements

Cochranes (Middlesbro') Foundry, Ltd., has opened an office at Lombard House, Great Charles Street, Birmingham, 3, with Mr. J. W. Elliot in charge.

A Large Gear Wheel Rim

The English Steel Corporation, Ltd., has recently produced under its 7,000-ton electro-hydraulic forging press at Vickers Works what is claimed to be the largest gear wheel rim ever forged in this country. This rim has a diameter of 14 ft. 3 in. The portion of the ingot for the rim after being trepanned with a 24-in. hole, was expanded under the press to slightly over 10 ft. in diameter, being re-heated and forged to 14 ft. 3 in. diameter. It is part of a single reduction geared turbine being constructed by Messrs. Cammell Laird & Co., Ltd., for the Ellerman Line. An impression of the size of this gear wheel rim can be obtained from the illustration.



A large gear wheel rim at the Vickers Works of the English Steel Corporation, Ltd.

Painting Books for the Kiddies

Until further notice the Benjamin Electric, Ltd., is dispatching copies of a children's painting book, which includes a competition, in all consignments of "Coolicon" shades.

Christmas Holidays

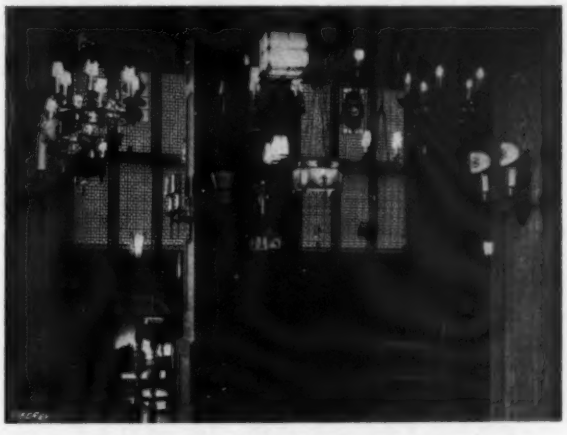
The offices and works of Rist's Wires & Cables, Ltd., were closed on Christmas Eve for the Christmas holidays and annual stocktaking, and they will reopen on January 1st.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that there will be no "cost-of-living" alteration in wages on the third pay-day in January.

"Efesca" Showroom Alterations

In order to provide further facilities for the display of lighting fittings, considerable alterations have been carried out recently at the showrooms of Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, London, E.C.1. A selection of metal and wood pendants and wall-brackets is seen to advantage in a new room panelled in limed oak with green and buff furniture and decorations. Ultra-modern fittings have special sections to themselves, and appropriate settings are provided for other types, such as chromium, tubular, semi-indirect, period, glass, wood and brass fittings, novelty and architectural lamps and advertising signs. Every unit is separately wired and can immediately be shown illuminated. The mistake of trying to show too many items at once has been avoided, all fittings being carefully spaced.



An "Efesca" lighting fittings showroom

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, December 23rd: No change in the price of copper bars (best selected), sheet and rod and spelter. English pig lead £18 10s., 5s. dec. English block tin £218 10s., £2 15s. dec.

New Catalogues and Lists

Brittain Electric Motors, Eastdown Works, Dermody Road. Lewisham, S.E.13.—Two leaflets dealing with a.c. electric motors.

Metropolitan-Vickers Electrical Co., Ltd., 75, Margaret Street, London, W.1.—Details of electric discharge lamps for industrial and street lighting.

Francis Lamp Locks, Ltd., 2/4, Cockspur Street, London, S.W.1.—Catalogues of lamp locks for bayonet and Edison screw cap lamps.

Walker Bros. (Electrical Engineers), Ltd., Quality House, Temple Row, Birmingham, 2.—A copy of "Electrical News," describing and illustrating apparatus suitable for Christmas gifts.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—An interesting technical publication on "Lamp Quality," written by Mr. A. B. Whitworth, has been produced.

Nathan & Allen, Ltd., 131, Victoria Street, London, S.W.1.—A high-quality publication describing 25 development years of the "Sauter" time switch has been issued. It contains some beautiful photography and is excellently produced.

Bankruptcy Proceedings

Anne Marcus, "Glendower," 58, Beatty Avenue, Matthew Bank, Newcastle-upon-Tyne, lately carrying on business as "Radio & Electric Store," 254, Shields Road, Newcastle-upon-Tyne, wireless dealer.—The public examination was resumed at Newcastle-upon-Tyne, recently. At the previous hearing it was disclosed that there was a deficiency of £213, and it was then suggested that debtor should see her accountant to enable her to submit a satisfactory explanation regarding the disposal of £150 which she had drawn from the business. Debtor now stated that she had not seen her accountant, and the Registrar, therefore, refused to close the examination.

A. J. Penn, trading as the Northampton Installation Co., 26B, Barrack Road, and 43, Gladstone Terrace, Northampton, electrical engineer and contractor.—This debtor attended at the County Hall, Northampton, recently, for his public examination. His statement of affairs showed ranking liabilities of £251 and assets of £23. The failure was attributed to competition, bad debts, and lack of capital. The examination was adjourned.

L. S. Walter, electrical engineer, 48, Broad Street, Banbury.—Receiving order made December 13th on debtor's own petition.

D. S. Williams, electrical engineer and contractor, 342, Dewsbury Road, Leeds.—First meeting December 30th at 24, Bond Street, Leeds. Public examination January 14th at the County Court House, Leeds.

C. E. Keates, electrical and mechanical engineer, 110, Brent Street, Hendon, N.W.—Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., released December 4th.

W. A. Jolly (Globe Equipment Co.), dealer in wireless parts and accessories, 36, Foleshill Road, Coventry.—Trustee, Mr. C. J. Band, 9-11, High Street, Coventry, Official Receiver, released December 12th.

H. W. King, wireless goods dealer, 124, Hither Green Lane. Lewisham, S.E.—First meeting January 1st at 29, Russell Square, W.C. Public examination January 28th at the Court House, Greenwich.

A. E. Beaumont, electrical and radio engineer, 216, Manchester Road, Thornton Lodge, Huddersfield.—First and final dividend of 3s. 11d. in the £, payable December 30th at 71, Manningham Lane, Bradford.

Company Liquidations

International Electrical Supplies, Co., Ltd., 464, Kingsland Road, London, E.8.—The statutory meeting of creditors herein was held on December 19th at Winchester House, Old Broad Street, London, E.C., when a statement of affairs was submitted showing liabilities of £5,704, of which £5,564 was due to trade and loan creditors, and the bank were partly secured creditors for £192, holding security valued at £52, leaving £140 to rank for dividend. The net assets were £2,697, with a deficiency of £3,007. The company was incorporated on April 19th, 1934. The authorised capital was £2,000, and was taken up and paid for by two shareholders. In June, 1935, the capital was increased to £3,000, and in addition one of the directors of the company had advanced about £1,000. Mr. H. L. Turk, accountant, said that when he investigated the company's affairs he found that there were a considerable number of orders, but there was not sufficient stock to execute them. The expenses of carrying on the business had been very heavy in comparison with the turnover done. The creditors passed a resolution for the appointment of Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., as liquidator of the company, with a committee of inspection.

Wallbrook Manufacturing Co., Ltd., electrical goods manufacturers, 73, Hatcham Road, London, S.E.15.—A meeting of creditors was held on December 14th in London, when the chair was occupied by Mr. S. E. Brown, a director of the company. The statement of affairs showed unsecured liabilities of £698, of which £663 was due to unsecured creditors, £25 due on a bill discounted, and other small liabilities for £10. There was a contingent liability in respect of rent, &c. The estimated amount available to meet the claims of the unsecured creditors was £609, with a deficiency of £89. The issued and allotted capital of the company consisted of 100 ordinary shares of 5s. each, and 1,000 preference shares of £1 each, so that as regards the contributories the total deficiency amounted to £1,114. The chairman said the directors of the company were himself, Mr. Wallace Brooksbank and Mr. T. B. Paine. The company was only formed in July last, the object being to manufacture electric fires, more especially for multiple stores, but it found that it could not obtain orders as had been hoped for, and the result was that the stock was largely unsuitable for other purposes. It was decided to confirm the voluntary liquidation of the company with Mr. Atkin as liquidator, a committee of inspection being also appointed.

F. Geere Howard, Ltd., 57, Berners Street, London, W.1, electrical contractors.—The statutory meeting of creditors was held in London on December 16th, when one of the directors of the company who presided said that the shareholders had passed a resolution nominating Mr. R. W. Gostick as liquidator. A statement of affairs submitted disclosed liabilities of £4,143, of which £2,528 was due in respect of cash advances; rent amounted to £175, and trade creditors' claims totalled £538. There was also an amount of £602 due for unpaid remuneration, professional fees, expenses, &c., and a contingent liability for £300 for dilapidations at 57, Berners Street, W., which was expected to rank. The assets were estimated to produce £2,150, from which had to be deducted £108 for preferential claims, leaving net assets of £2,042, with a deficiency of £2,101. It was stated that it was impossible to ascertain what a certain debt would eventually realise for the unsecured creditors. There was a possibility, however, that if everything went satisfactorily there might be a dividend of about 10s. in the £ in the liquidation. A resolution was passed confirming the appointment of Mr. Gostick as liquidator, with a committee of inspection. The following are creditors: Sun Electrical Co., £293; W. T. Glover & Co., £98; Press Steel Co., Ltd., £43.

High Level Batteries, Ltd.—Winding up voluntarily. Liquidator, Mr. T. Rodger, 29, Grainger Street West, Newcastle-upon-Tyne.

Government Contracts Recently Placed

THE following contracts were placed by various Government Departments during November:—

ADMIRALTY.

W.t. accessories.—Gambrells, Rowse & Snoaden; Marconi's; H. W. Sullivan; G.E.C.

Steam turbo-alternator sets.—C. A. Parsons & Co. Sub-contractors for switchgear: G.E.C.; B.T.H.

Motor alternators.—Mawdsleys; Newton Bros. (Derby); Electric Construction Co.; Electro Dynamic Construction Co.

Tuner amplifiers, units, transmit receivers, &c.—Marconi's.

Dry batteries.—Siemens Bros.

Electric cable.—Anchor Cable Co.; B.I. Cables; Craigpark Electric Cable Co.; Derby Cables; Edison Swan Cables; Enfield Cable Works; G.E.C.; W. T. Glover & Co.; Hackbridge Cable Co.; Henley's; Hooper's Telegraph & I.R. Works; Johnson & Phillips; Macintosh Cable Co.; Mersey Cable Works; Metropolitan Electric Cable & Construction Co.; St. Helens Cable & Rubber Co.; Siemens Electric Lamps & Supplies; Ward & Goldstone.

Condensers.—Gambrells, Rowse & Snoaden; Johnson & Phillips; H. W. Sullivan; Marconi's; Telegraph Condenser Co.; Muirhead & Co.; Dubilier Condenser Co. (1925).

Contactors.—Everett, Edgcumbe & Co.

Rotary convertor set.—Brush Electrical Engineering Co.

Electric jib crane.—Babcock & Wilcox. Sub-contractors: Veritys for motors; Electro-Mechanical Brake Co. for control gear.

Oil driven electric generating sets.—J. & H. McLaren. Sub-contractors: W. H. Allen, Sons & Co. for dynamos; Hamworthy Engineering Co. for compressors; Drysdale & Co. for pump.

Junction boxes, boards, &c.—Wm. McGeoch & Co.; Whipp & Bourne.

Electric lamps.—G.E.C.; Siemens Electric Lamps & Supplies; B.T.H.; Ediswan.

Mountings and holders for w.t. valves.—Gambrells, Rowse & Snoaden; G.E.C.; R.I., Ltd.; H. W. Sullivan.

Searchlight projectors.—Laurence, Scott & Electromotors; Met.-Vick. Elecl. Co.

Resistances, &c.—R.I., Ltd.; H. W. Sullivan; Cressall Manufacturing Co.; Zenith Electric Co.; Veritys.

Starters and regulators.—E. N. Bray; Rheostatic Co.; Watford Electric & Manufacturing Co.

Switchgear.—B.T.H.; Whipp & Bourne.

Switch fuse panels.—Whipp & Bourne.

W.t. valves.—G.E.C.; Ediswan; Mullard Radio Valve Co.

WAR OFFICE.

Electric cable, &c.—Siemens Bros.; Henley's; Callender's Cable & Construction Co.; Macintosh Cable Co.; Concordia Electric Wire Co.; Edison Swan Cables.

Electric meters.—Ferranti.

Telephone sets.—G.E.C.

Universal electric test benches.—Brown Bros.

X-ray apparatus.—C. Andrews.

AIR MINISTRY.

Accumulators.—Oldham & Son; Chloride Electrical Storage Co.; Batteries, Ltd.

Batteries.—Batteries, Ltd.

Charging boards.—Walsall Electrical Co.

Electric lamps.—G.E.C.; Johnson & Phillips.

Pedestal lamps.—J. Bradbury & Son.

Underground cables.—Derby Cables.

Cut-outs and wavemeters, &c.—Gambrells, Rowse & Snoaden.

Generators.—Mortley, Sprague & Co.; Small Electric Motors; Rotax.

Repairs to generators.—Newton Bros. (Derby).

Electric leads.—D. H. Bonnella & Son.

Metal rectifiers.—Westinghouse Brake & Signal Co.

Microphones.—Siemens Bros.

Milliammeters.—Ferranti.

Plugs and sockets.—Cox, Walker & Partners; Vickers (Aviation).

Projectors.—B.T.H.

Telephone receivers.—Telephone Manufacturing Co.

W.t. receivers.—Marconi's; Standard Telephones.

Remote control equipment.—Plessey Co.; Marconi's.

Electric starters.—Rotax.

Switches.—Cox, Walker & Partners; G.E.C.

Switch boxes.—Phœnix Telephone & Electric Works.

Transmitters, rectifiers, and w.t. equipment.—Marconi's.

W.t. valves.—Ediswan.

POST OFFICE.

Telegraphic apparatus.—Creed & Co.; Power Equipment Co.; Standard Telephones.

Telephonic apparatus.—Ericsson Telephones; G.E.C.; Hall Telephone Accessories (1928); Phœnix Telephone & Elect. Works; Revo Electric Co.; Siemens Bros.; Standard Telephones; Telephone Mfg. Co.

Testing and protective apparatus.—Birkbys; Electric Construction Co.; G.E.C.; Phœnix Telephone & Electric Works.

Wireless apparatus.—Philip Medawar.

Terminal blocks.—Thos. De La Rue & Co.; Ebonestos Insulators.

Cable.—Connollys (Blackley); Submarine Cables; United Telephone Cables.

Secondary cells.—Accumulators of Woking (1928); Alton Battery Co.; Britannia Batteries; Chloride Elecl. Storage Co.; D.P. Battery Co.; Hart Accumulator Co.; Pritchett & Gold & E.P.S. Co.; Tudor Accumulator Co.

Conduit.—G.E.C.; Longmore Bros.

Telephone cords.—London Electric Wire Co. & Smiths; Phœnix Telephone & Electric Works; Reliance Electrical Wire Co.

Rectifiers and elements.—Westinghouse Brake & Signal Co.

Leclanché jars.—A. W. Buchan & Co.

Cadmium copper wire.—T. Bolton & Sons; B.I. Cables; I.C.I. Metals; Richard Johnson & Nephew; F. Smith & Co.; Whitecross Co.

Replating of batteries.—Catterick repeater station; Birmingham (Northern): Britannia Batteries.

Telegraph and telephone equipment.—War department: Standard Telephones.

Co-axial cabling.—London-Birmingham: Standard Telephones.

Telephone exchange equipment.—Bishopsgate Tandem & Wood Street exchange building (London); Cosham (Portsmouth).—Automatic Electric Co. Chatham; Winchmore Hill (London); Belfast; Scarthoe and Cleethorpes (Grimsby); Fforestfach (Swansea); Brighton; Grimsby.—Siemens Bros. Sub-contractors: Hart Accumulator Co.; Electric Construction Co. Dundee; Kensington (London).—G.E.C. Richmond (London); Canterbury.—Ericsson Telephones. Sub-contractors for Canterbury: Chloride Elecl. Storage Co.; Harland Engineering Co.; Electric Construction Co. Mill Hill (London).—Standard Telephones.

Telephonic amplifier equipment.—Kendal: Standard Telephones.

Telephonic repeater equipment.—Glasgow; Marks Tey; Leeds: Standard Telephones.

Telephonic repeater and amplifier equipment.—Elgin: Standard Telephones.

CROWN AGENTS FOR THE COLONIES.

Copper wire.—Henley's.

Dry core cable.—Standard Telephones.

Electric portal crane.—Cowans, Sheldon & Co.

Motor and switchgear.—B.T.H.

Static transformers and switchgear.—Met.-Vick. Elecl. Co.

Surge absorbers.—Ferranti.

Telephone equipment, &c.—G.E.C.

Turbo-generating plant.—Gilbert Gilkes & Gordon.

X-ray equipment.—Schall & Son.

Electricity Supply

Lighting, Domestic, Power

Aberystwyth.—LOAN TO PURCHASE UNDERTAKING.—The Town Council has applied for a loan of £50,000 for the purchase of the electricity undertaking. A further loan of £4,250 is required for distribution extensions, assisted wiring, meters and services.

Appleby.—SUPPLY TO COUNCIL HOUSES.—Permission has been given to the Westmorland and District Electricity Co., Ltd., to install electricity in Council houses at Thanet Terrace, provided that the cable is placed underground and that no gas fittings are removed.

Ashton-under-Lyne.—DOMESTIC APPARATUS.—Application is being made to the Electricity Commissioners for sanction to borrow £20,000 for domestic apparatus, and £6,000 for meters.

Barrow-in-Furness.—TWO VILLAGES CONNECTED.—The Corporation has carried out extensions to Hawkshead and Colthouse.

Birmingham.—SUGGESTED REORGANISATION.—A request was made at a meeting of the City Council recently that "the hiring of electrical apparatus to domestic consumers should be arranged on more democratic lines." Sir Percival Bower, chairman of the Electric Supply Committee, replied that a sub-committee had been appointed to consider whether it should not take advantage of the present opportunity completely to reorganise the department. Among the matters to be considered was that involved in the question raised.

Blackburn.—BULK SUPPLY.—The electrical engineer has been authorised to negotiate with the Darwen electrical engineer with a view to obtaining a new agreement for the bulk supply of electricity to Darwen when the present agreement terminates.

Bournemouth.—BATH HEATING.—The Baths Committee has decided to heat the Pier Approach baths electrically.

Brentwood.—ALLEGED IRREGULAR PROCEDURE.—An application of the Urban District Council for sanction to borrow £1,165 for public lighting was opposed by the Brentwood and District Electric Co., Ltd., at a recent Ministry of Health inquiry on grounds of irregular procedure in dealing with the tenders.

Bridlington.—STREET LIGHTING.—The Council proposes to undertake an extensive new scheme of street lighting by electricity costing between £3,000 and £4,000.

Caernarvon.—RELIEF LINE.—The North Wales Power Co. is taking steps in regard to the erection of a relief line from Penmaenmawr to Bangor as suggested by the Council.

MAINS AND SERVICES.—The Council is making application for sanction to borrow the sum of £3,000 for prospective unspecified expenditure upon mains and services.

Cardiff.—EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £1,974.

Carlisle.—LOANS.—The City Council has obtained permission to borrow £1,636 for mains and plant and £9,345 for coal handling plant, and is also seeking sanction to a loan of £7,000 for its assisted wiring scheme. A sum of £1,805 is to be spent on extending the mains.

Chelmsford.—LOWER CHARGES.—The County of London Electric Supply Co., Ltd., has reduced the running charge on the two-part tariff for business, domestic and industrial supplies to ¾d. per kWh; and there is a special water-heating rate of ¼d. per kWh.

Cheltenham.—STREET LIGHTING.—The Electricity Committee is to provide street lighting on the first section of the Whaddon Farm estate at a cost of £224.

Chester.—AN ILLUMINATION TARIFF.—The Electricity Committee has decided to grant special facilities to shopkeepers desiring to make extra use of electricity for outside illuminations. Only 1¼d. per kWh is being charged for shop window and outside illumination provided it is not used before 4.45 p.m.

FLOODLIGHTING THE CATHEDRAL.—Until the end of the year the Cathedral is being floodlighted with sixty-four projectors. The stained-glass window at the west end is illuminated from the interior of the building, giving a very fine effect from the Market Square, and the whole of the south and east sides are lighted in amber up to the clerestory, which is illuminated in red. The towers on each side of the south-west door are bathed in amber light, while the space between the towers is coloured red. The tower and the cenotaph are floodlighted in white.

Darlington.—NEW FEEDER.—The Town Council is to lay an h.v. feeder cable along Willow Road to the sub-station near the recreation ground.

MAINS.—Electricity mains are to be extended in Vulcan Street and Lambton Street.

Denny and Dunipace.—OPPOSITION TO THE FORMATION OF LARGE SUPPLY AUTHORITIES.—The Town Council has decided to oppose the formation of large supply authorities which would supersede the Town Councils of small burghs as distributing authorities, as proposed by a convention of burghs.

Dewsbury.—NEW TARIFF.—The Town Council is to supply electricity on the rateable-value system at ¾d. per kWh for the first 200 kWh per winter quarter or summer half year, and at ½d. per kWh beyond that amount.

Didcot.—IMPROVED LIGHTING.—As the first stage of a scheme to improve the lighting in the whole area, the Parish Council has authorised an increase in the wattage of twenty-six lamps at the Broadway. A new agreement, retrospective to October 1st last, has been arranged between the Wessex Electricity Co. and the Council. This provides more favourable terms for street lighting.

Dover.—LOAN.—In connection with plant, transformers and switchgear for the change-over the Town Council has received sanction to a loan of £2,860.

Durham.—ELECTRICITY IN SCHOOLS.—The Board of Education has approved the installation of electric lighting in two schools.

Ebchester (Co. Durham).—CONVERSION OF GAS LIGHTING.—Among improvement schemes to be carried out next year is the replacement of gas lamps by electric street lighting.

Exeter.—SUB-STATIONS.—The Electricity Committee is seeking to borrow £7,500 for sub-stations.

Fleet.—OVERHEAD LINE.—The Urban District Council has consented to the erection of an overhead cable in Cove Road by the Mid-Southern Utility Co., Ltd.

Fleetwood.—GENERATING PLANT TO BE CLOSED DOWN.—It is reported that the generating plant, which was taken over from the Council by the Central Electricity Board in 1932, is to be closed down at the end of the year. The station has been in use since 1901, but since the operation of the grid scheme it has only been used at irregular intervals. Work will be found for the displaced employés in the distribution department.

Gateshead.—CABLE-LAYING.—The North-Eastern Electric Supply Co., Ltd., is to lay l.v. mains in Pimlico, Highcliffe Gardens, Highfield Road, High Fell estate, and Ravensworth Coach Road.

Grantham.—PURCHASE RESOLUTION RESCINDED.—It was stated at a meeting of the Town Council recently that the Electricity Commissioners required that the Council should permit an outside authority to manage the electricity undertaking in the town on its behalf. In view of this, and of a statement that the Urban Electric Supply Co., Ltd., had promised to reduce its tariffs, it was decided to rescind a former resolution giving notice of the Council's intention to purchase the Grantham undertaking of the company.

Great Cumbrae.—PROPOSED GENERATING PLANT.—An agreement has been reached between Millport Burgh Council and the newly formed Cumbrae Electricity Supply Co., Ltd., by which the company is to build a generating station on the island of Great Cumbrae, where the burgh is situated.

Great Yarmouth.—PROGRESS OF UNDERTAKING.—In the last financial year reduced charges represented a loss of not less than £8,000 in revenue, but the demand has expanded considerably as a result of the more favourable terms. Last month 192 new accounts were opened, bringing the total number of consumers up to 27,112. It is hoped that next year the department will be in a position to make further concessions.

Floodlighting reveals the beauty of Chester Cathedral

Guernsey.—CHEAPER ELECTRICITY.—A reduction in the price of electricity—the third since the States Electricity Board assumed control of the supply in the autumn of 1933—is announced in the *Guernsey Evening Press*. Hitherto, under the flat rate, the first 250 kWh of electricity used per quarter

has been charged at 6½d. per kWh and the remainder at 6d., but now all consumption is to be at the lower rate. The two-part tariff running charge is now reduced to 1d., and a special rate of 5½d. per kWh is to be made in the case of places of worship, schools, hospitals and parochial buildings. The past concessions have resulted in a considerable expansion in the demand for electricity. The increase in the number of domestic and industrial appliances is substantial, the connections for the past three years having been 391, 580 and 1,072 kW. The total load connected to the system at present is well over 11,000 kW. The board is installing new generating machinery.

Guildford.—SUPPLY TO WONERSH PARK.—Mains and plant are to be extended at a cost of £2,190 to provide a supply to Wonersh Park.

Hamilton.—CONTROL OF ELECTRICITY SUPPLY.—The Town Council has instruoted its representatives at a conference of local authorities on the question of electricity supply, to take up the position that, in the event of any reorganisation of the electricity industry in respect of distribution, such organisation should be founded on public ownership, or public trust, and should not be handed over to any limited company or group holding shares in statutory undertakings now engaged in generation distribution of electricity.

Inverness-shire.—OPPOSITION TO POWER SCHEME.—The Caledonian Power Company's Provisional Order is to be opposed by the County Council in order to secure alterations to certain clauses, particularly with regard to rateable value.

Ipswich.—LINE TO BE PLACED UNDERGROUND.—Part of the overhead line to Woodbridge is to be placed underground by the Electricity Committee at a cost of £1,375.

Leslie (Fifeshire).—ALTERNATIVE SUPPLY CABLE.—The electricity supply to the burgh was recently interrupted, due to a fault in the line near Thornton. The Fife Electric Power Co. is providing an alternative cable.

WAYLEAVE AGREEMENT.—The Council has authorised the signing of a wayleave agreement with the Fife Electric Power Co. in connection with an extension to Strathenry.

Lichfield.—EXTENSION OF SUPPLY.—The City Council is to give a supply of electricity to Muckley Corner, at a cost of £387, and a loan for this sum has been applied for, together with the consent of the Minister of Transport to the erection of overhead lines.

London.—HACKNEY.—The Electricity Committee has obtained sanction to borrow £30,000 for mains extensions.

HAMMERSMITH.—The lighting in Goldhawk Road is to be improved at a cost of £2,000 by the installation of mercury vapour electric-discharge lamps.

L.C.C.—Electric clocks are to be provided at the Grove Hospital, Tooting, at a cost of £900.

ST. PANCRAS.—The Housing Committee has given permission to the Electricity Department to equip a flat on the Ferdinand Place housing estate, and also on any future estate, for the purpose of demonstrating domestic apparatus for all-electric dwellings. Sanction has been obtained to a loan of £32,055 for mains and services, £9,025 for sub-stations, £9,334 for wiring, and £9,754 for meters. A sub-station is to be erected in Ferdinand Place at a cost of £2,075.

STOKE NEWINGTON.—The Electricity Committee has considered the possibility of meeting a demand for a low rate for electricity for temporary decorative lighting and recommends a flat rate for this purpose of 1d. per kWh.

Lowestoft.—MAINS AND SERVICES.—Sanction to borrow £20,021 for mains and services has been obtained by the Electricity Committee.

New Zealand.—USE OF ELECTRICITY.—According to the Australian *Electrical Engineer and Merchandiser* the Prime Minister of New Zealand (Mr. G. W. Forbes), speaking at the opening of the annual conference of the Electric Power Boards' and Supply Authorities' Association, said that the amount of electricity sold *per capita* had increased from 472 kWh to 493 kWh, the average retail price per kWh sold being now 1.173d.

Paignton.—INSTITUTION INSTALLATION.—The Urban District Council is inviting tenders for the installation of electric lighting at the isolation hospital.

Shrewsbury.—SUPPLY SCHEME.—It had been suggested that the Town Council should endeavour to obtain powers to extend its supply area to include areas recently incorporated in the borough, but in view of the attitude of the West Midlands Joint Electricity Authority the Electricity Committee now proposes to abandon the application. At the same time it is considered that a proposal of the J.E.A. to purchase the Council's undertaking should not be entertained, but that efforts should be concentrated on the launching of a programme of renewal and extension in the old borough. It is estimated that the total cost of such extension, renewal and gradual change over to a.c. would amount to £100,000.

Slaithwaite.—MAINS EXTENSIONS.—The Urban District Council has received sanction to a loan of £1,070 for mains and sub-station equipment. An extension is to be provided to Highfield at an estimated cost of £280.

Floodlighting of the Supreme Court Buildings, Johore, India, carried out by the G.E.C.

South Africa.—MORE PLANT FOR JOHANNESBURG.—The rapid extension of Johannesburg has so completely outrun the capacity of the municipal undertaking to supply sufficient electricity for the city's domestic and industrial needs that further extensions to the power station are urgently needed. Application, made last July, for permission to borrow £335,000 for the installation of a 20,000-kW extension to the Jeppe Street power station having now been approved, the City Council has decided to proceed with the work. When this new set is installed the total capacity of the station will be 90,000 kW. Among other expenditure sanctioned at the same time was £10,000 for the purchase of transformers, £12,000 for augmenting the bulk supply for industrial purposes, and £5,000 for strengthening mains.

EXTENSIONS AT SPRINGS.—The Provincial Administration of the Transvaal has approved the raising of a loan of £100,000 by the Town Council of Springs, Far East Rand. The allocation includes £23,750 for extensions to the electricity undertaking and £12,000 for a new fire station and equipment.

Southampton.—LOANS FOR DEVELOPMENT.—The Electricity Committee has received sanction to the borrowing of £32,212 in respect of mains and plant in connection with a proposed new feeder to Eastleight, *via* Woolston; improving the supply to Netley; and an increase of supply to works in South Mill Road, Millbrook. The Electricity Commissioners have also consented to an amount not exceeding £17,600 from the 1934-35 net surplus being used to meet expenses chargeable to capital.

Stanhope (Co. Durham).—STREET LIGHTING.—A scheme for extending the electric street-lighting system in Upper Weardale at a cost of £450 is to be considered by the Urban District Council.

Stoke-on-Trent.—ELECTRIC STREET LIGHTING.—Consideration is being given by the Electricity Committee to the lighting of the main thoroughfares by electricity.

Tynemouth.—REVISED TARIFFS.—During the winter months the charge for lighting houses will be 1s. a month for each room, as compared with 1s. 6d. at present, while for summer months the old rate of 1s. will continue. For public-assistance institutions the old rate of 5½d. per kWh for the first 1,000 kWh is being reduced to 3½d., while a reduction is also being made in the tariff for electricity supplied to cinema projectors.

Warrington.—SPECIAL TARIFF.—The charge for electricity for charging vehicle batteries between the hours of 7 p.m. and 7 a.m. has been fixed at ½d. per kWh by the Electricity Committee.

West Hartlepool.—TARIFF FOR CINEMAS.—The Town Council has introduced a special rate of 2d. per kWh for electricity supplied for cinema projectors.

Weymouth.—SUPPLIES TO LULWORTH.—The Town Council is to proceed immediately with the extension of the supplies in the Lulworth area.

Traction

Brighton.—VOTE AGAINST TROLLEY-BUSES.—At a crowded public meeting last week the Corporation's proposal to introduce trolley-buses was defeated by 598 to 528 votes. It is considered likely that the Corporation will take a poll of the town.

London.—TRAFFIC SIGNALS.—Consideration is being given by the City Corporation to a proposal that traffic signals shall be installed at the junction of New Bridge Street, Blackfriars Bridge, Queen Victoria Street and the Embankment. Signals have also been proposed for the junction of Davis Street, Brook Street and Grosvenor Street.

WAR OFFICE LOCOMOTIVES.—Two of the 50-h.p. electric battery locomotives operating at War Office depôts have just been converted to diesel-electric propulsion in order to make them more suitable for working over short lines with heavy grades where the drain on the battery is considerable. The original traction motors have been retained.

Kent.—A NEW STATION.—A new Southern Railway station, being constructed at Falconwood, between Eltham Park and Welling, is to be opened on January 1st.

Manchester-Sheffield.—ELECTRIFICATION PLANS.—Preliminary estimates for the conversion to 1,500-V d.c. of the Manchester to Sheffield L.N.E.R. main line show that 160 electric locomotives will be required for hauling the goods and passenger traffic, and thirteen of these will come from the Newport to Shildon line, in Durham, which was closed to electric traction in January last.

South Africa.—DIESEL-ELECTRIC LOCOMOTIVE.—The Consolidated Goldfields Corporation has ordered an English Electric standard diesel-electric shunting locomotive.

Communications

Burma.—RADIO-TELEPHONY.—Rangoon, Mandalay, Prome and Bassein will be linked with India and other countries in five months' time when a new radio station is expected to be complete. For telephoning to Europe and America transmission will be by radio from Mingaladon to Madras, while from Madras to Poona the transmission will be by land line. At Poona telephone messages will be relayed by radio to Great Britain and thence to their destination.

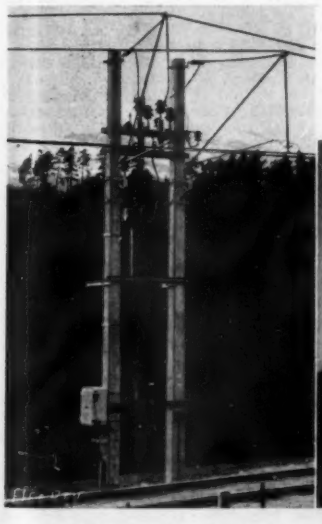
France.—TELEPHONE DEVELOPMENT POSSIBILITIES.—In a recent issue of the *Revue des Téléphones, Télégraphes et T.S.F.* attention is drawn to the possibilities of development in the use of telephones in France. A table shows that with 1,365,717 telephone subscribers at the commencement of the present year France was tenth in the list of European telephone-using countries, having 3.2 telephones per 100 inhabitants. The author of the article estimates that with a little enterprise there is scope for an immediate increase of nearly a million telephone subscribers, over half of which would comprise small manufacturers and traders. He recommends the establishment of many more public telephone kiosks.

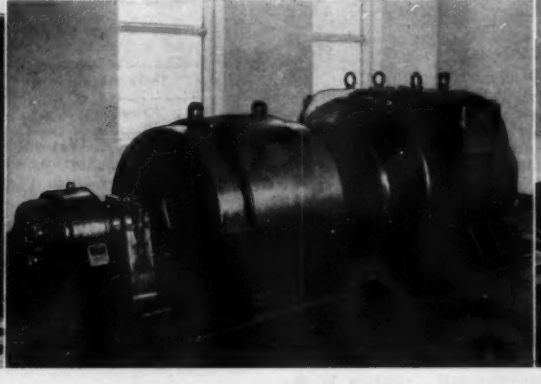
Great Britain.—TELEVISION.—The *Daily Telegraph* reports that the B.B.C. has discovered, before the Alexandra Palace television station is ready, that the £180,000 allocated for the establishment and maintenance of the service until the end of next year is insufficient. This has become apparent since the contracts were placed for the two transmitters and the adaptation of the building. Half the £180,000 was contributed by the Exchequer and the other half by the B.B.C. The balance now available for programmes and staff salaries is held to be inadequate, and money will have to be provided from the general funds of the B.B.C.

A Norwegian Electrified Railway

THE railway between Voss and Granvin, Norway, has recently been electrified. Three-phase, 50-cycle power was available at 20 kV, but the trains are operated on the single-phase, 16⅔-cycle system at 16 kV, motor generators being used to convert the power for traction. Two of these machines are housed in a sub-station at Vossevangen. They run at 1,000 r.p.m. and are fed through transformers which step-down the high voltage to 6,300 V.

Special starting transformers are provided for the driving motors. The generators differ from those previously used in that they have single-phase rotor windings and excited stators, the latter being built like those of d.c. machines with two poles only. The normal voltage generated in the rotor is 1,150 V, which is taken off by means of slip rings on the shafts. This is then stepped up by single-phase transformers to 16 kV for energising the trolley line. These transformers are placed in a separate building, and are of the natural air-cooled type.





Left: A booster transformer on the densely wooded Norwegian mountain slopes. Centre: A motor-generator set in the sub-station. Right: Interior of the driver's cab in a motor coach

As the traffic on the line will vary a good deal, being heavy in summer during the tourist season and light in winter, it is intended to use both sets together at peak periods.

The trolley line is similar to those of previously electrified Norwegian railways. It is composed of a carrying cable from which hangs a contact wire of 80 sq. mm. section. To ensure a proper return circuit the sections of rail are joined with flexible copper junctions.

Small transformers have been installed in the stations to step down the pressure to 230 V for heating the station and for outside lighting. For inside lighting it is still further stepped down to 12 V, which at 16⅔ cycles gives a less flickering light. The signal and telephone circuits necessary for operating the line are placed in a cable buried in the embankment. As the electrification of the line required the moving of existing public telephone lines, it was agreed with the Telegraph and Telephone Administration to put these in the same cable.

On account of the considerable variation in the traffic on the line and also of the gradient, which in places amounts to 5½ per cent., it was decided to use motor coaches, instead of locomotives, to which one or two carriages can be coupled. The coaches are about 53 ft. long and weigh 35½ tons. Each is provided with four single-phase motors coupled in series and rated at 116 kW each at 255 V. The 16 kV line voltage is retransformed in the coach, the output varying from 143 to 600 V. These coach transformers feeding the motors have a series of nine taps, the highest of which is intended only for use in emergency. The motors are connected directly to the driving shafts by a transmission gear with a ratio of 10 to 55. The maximum speed of the motors is 2,250 r.p.m., corresponding to a speed of 62.5 km.p.h.

Electric brakes are used to reduce the speed to 20 km.p.h., and the train can then be brought to a standstill by the air brakes.

Coach heating is electric at 1,000 V and for lighting a small transformer steps down the supply to 12 V.

Contract Information

When "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Argentina.—BUENOS AIRES.—January 21st. State Railways Administration. Underground cable, joint boxes, insulating tape, &c. (T.Y. 10269.)*

Australia.—BRISBANE.—March 10th. City Electric Light Co. 11,000-V and 415-V switchgear. (T.Y. 10264.)*

MELBOURNE.—January 29th. City Council. Totally enclosed metal-clad switchgear for the Spencer Road power station. (T.Y. 10257.)* Four 10,000-kVA oil-immersed transformers. (T.Y. 10276.)*

February 17th. State Electricity Commission of Victoria. Three oil-insulated outdoor type automatic induction voltage regulators with accessories. (T.Y. 10277.)*

Beckenham.—December 30th. Borough Council. Two transformers. (December 13th.)

Bexley.—January 20th. Electricity Department. Cable with jointing, transformer and switchboard. (December 13th.)

Birmingham.—January 8th. Salvage and Stables Committee. Twenty-three lead-plate batteries for electric vehicles. (December 20th.)

January 10th. Electric Supply Committee. Five motor-driven sewage effluent pumps and ancillary works for the Hams Hall power station. City electrical engineer, 14, Dale End (deposit £2).

Blackwell.—January 8th. R.D.C. Two electrical sewage pumping installations, with vertical-spindle centrifugal pumps and motors, for the Hilcote and B. Winning sewage and South Normanton sewage disposal works extensions. A. H. Elliott, Gilcroft Chambers, Church Lane, Mansfield (deposit £2 2s.).

Brecknockshire.—January 6th. County Council. L.p. hot-water heating and electric lighting and power installations at the Brecon County (Girls') School. H. C. W. Strickland, County architect, Watton Offices, Brecon.

Coventry.—January 25th. Electricity Department. One 30,000-kW turbo-alternator and two water-tube boilers. (December 13th.)

Dartford.—January 11th. Cable and joint boxes. (See this issue.)

Great Yarmouth.—December 31st. Electricity Department. Twelve months' supply of kiosks. (December 20th.)

India.—NEW DELHI.—January 16th. Stores Department. One 30-ton electric crane for the locomotive workshops, Moghalpura. Director-General, India Store Department, Belvedere Road, S.E.1 (deposit 10s., not returnable).

Iran.—TEHERAN.—Ministry of Posts, Telegraphs and Telephones. Telegraph poles and accessory equipment. (See this issue.)

Irish Free State.—DUBLIN.—January 31st. Electricity Supply Board. Twelve months' supply of power transformers. (December 20th.)

January 8th. Commissioners of Public Works. Electric lighting at the Custume Barracks, Athlone. T. Cassedy, Office of Public Works (deposit £1).

SWINFORD.—January 10th. Mayo Board of Health. Electrical installations in the new fever hospital. P. J. Munden, 1, South Frederick Street, Dublin (deposit £5 5s.).

Kettering.—December 30th. Electricity Department. Cable, (December 13th.)

Lexden and Winstree.—December 31st. R.D.C. Electrically driven centrifugal well and booster pumps and base-exhange water-softening plant for the pumping station at Mount Bures. Sands & Walker, Milton Chambers, Nottingham (deposit £2 2s.).

London.—CENTRAL ELECTRICITY BOARD.—January 27th. 132,000-V overhead transmission lines for the Central England Electricity Scheme, 1928. (December 13th.)

METROPOLITAN WATER BOARD.—February 25th. Eight steam turbines with centrifugal pumps, electric generators, &c., at the pumping station, Hampton. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £5 5s. to be deposited with the accountant of the Board).

Manchester.—January 21st. Electricity Committee. Electric cookers. (See this issue.)

New Zealand.—WELLINGTON.—February 4th. Public Works Department. Switchgear for the Mareretu Tahekeroa and Maungatapere stations. (T.Y. 10274.)*

Northern Ireland.—BELFAST.—January 16th. Electricity Department. Materials for twelve months. (See this issue.)

Rhyl.—December 31st. Electricity Department. L.p. cable. (December 13th.)

St. Helens.—December 30th. Electricity Department. Feeder pillars and underground disconnecting boxes. (December 13th.)

Salford.—January 7th. Corporation. Two electrically propelled vans. (See this issue.)

January 15th. One 12,500-kVA transformer. (See this issue.)

Scunthorpe and Frodingham.—January 6th. Electricity Department. One sheet-steel kiosk and a 200-kVA transformer. (December 13th.)

Seaham Harbour.—U.D.C. Sub-station equipment, comprising metal-clad switchgear. J. S. Forster, electrical engineer, Electric House.

Southend-on-Sea.—January 9th. Electricity Department. H.p. underground cables. (December 13th.)

January 8th. Electric discharge lamps, lanterns and brackets. (See this issue.)

Southport.—December 28th. Transport Committee. Electrical installation at the transport depôt. (December 20th.)

Stockport.—January 7th. Sewage Outfall Committee. Electric motors, &c. W. F. Gardner, Borough surveyor, Town Hall (deposit £2 2s.).

Swindon.—January 10th. Electricity Department. Underground h.p. cables and sub-station equipment. (December 13th.)

Torquay.—January 4th. Waterworks Department. Electrically driven centrifugal booster pump, to deliver 104,000 gall. per hour. Water engineer, Town Hall.

Uruguay.—MONTEVIDEO.—February 7th. State Electricity Supply and Telephone Administration. Underground armoured cable. (T.Y. 10259.)*

February 10th. Static transformers. (T.Y. 10260.)*

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Durham.—County Education Committee. Accepted. Electrical installations in schools: Annfield Plain Girls (£79) and Burnhope New Council (£154).—T. W. Atkinson, Oxhill, North Brancepeth Council (£248).—W. E. Dove & Co., Ltd., Darlington.

Hull.—Telephones Committee. Accepted. Cable (£333).—W. T. Henley's Telegraph Works Co., Ltd. Another firm quoted £245 for foreign cable.

London.—BERMONDSEY.—Electricity Committee. Recommended. Two 250-kVA transformers (£357).—British Electric Transformer Co., Ltd. Three h.p. switches (£439).—A. Reyrolle & Co., Ltd. Five l.p. switches (£235).—Crompton Parkinson, Ltd.

HAMMERSMITH.—Electricity Committee. Recommended. E.h.p. 11,000-V, three-phase, metal-clad switchgear for the supply to new flats in Shepherd's Bush Road (£1,041).—Ferguson, Pailin, Ltd. This was one of ten tenders, the highest being £1,214.

L.C.C.—Accepted. Wiring and fittings for electric lighting, &c.:

Blocks 1 and 2 of dwellings on the Dickens estate (George Row area), Bermondsey:

	£
Pemberton and Sturgess (Great Britain), Ltd. (Accepted)	**588**
City Electrical Co.	690
Davis Myer & Co.	709
Leather & Strong	818
Francis Polden & Co., Ltd.	927
Electrical Installations, Ltd.	987
Ellis & Ward, Ltd.	1,060
B. C. Bullard & Co.	1,267
Shaw Bros.	2,141

St. David's Hospital, Edmonton:

	£
L. G. Tate & Co., Ltd. (Accepted)	**1,834**
Read & Partners, Ltd.	2,162
Gillham & Jones	2,208
A. Hawkins & Sons	2,269
W. J. Furse & Co. (London), Ltd.	2,276
City Electrical Co.	2,328
G. E. Taylor & Co.	2,531
Pinching & Walton	2,701
Blackburn, Starling & Co., Ltd.	2,761

Laundry block, Hackney Hospital (Institution):

	£
G. E. Taylor & Co. (Accepted)	**847**
City Electrical Co.	856
Samuel Reed & Sons	877
T. Clarke & Co., Ltd.	914
Pinching & Walton	915
Grant & Blake, Ltd.	975
Keeble, Ltd.	1,003
Electrical Installations, Ltd.	1,071
Higgins & Cattle, Ltd.	1,155
Berkeley Electrical Engg. Co., Ltd.	1,175

City of London Institution, Bow:

	£
S. Reed & Sons (Accepted)	**602**
F. G. Edey & Co., Ltd.	685
Pinching & Walton	694
A. Meckhonik	717
Buchanan & Curwen, Ltd.	737
Gillham & Jones	773
G. E. Taylor & Co.	827
Marsh Brothers (Electric), Ltd.	945
E. Dyne & Co., Ltd.	951
Anderson, Angell & Co., Ltd.	992

Wiring for electric lighting and heating at schools: Haselrigge Road, Clapham (£1,043).—S. Reed & Sons. This was the lowest of eight tenders, the highest being £1,345. Heckford Street, Limehouse (£567).—Jacob White & Co., Ltd. North Hackney Central and Millfields Road Elementary, Hackney North:

	£
Henfrey Electrical Installations (Accepted)	**949**
J. Hunter & Co.	980
A. Higginbotham & Sons	1,024
Jacob White & Co., Ltd.	1,165
Electrical Installations, Ltd.	1,172
F. G. Edey & Co., Ltd.	1,218
W. H. Gaze & Sons, Ltd.	1,220

	£
Grant & Blake, Ltd.	1,227
Holliday, Hall & Stinson, Ltd.	1,239
Harland & Wolff, Ltd.	1,830

Walworth Central, Southwark, S.E.:

Commercial Light, Heat and Power Co. (Accepted)	**597**
H. J. Cash & Co., Ltd.	685
Carr Bros.	730
F. Angell & Co., Ltd.	745
A. Meckhonik	758
Jacob White & Co., Ltd.	968
Buchanan & Curwen, Ltd.	999
City Electrical Co.	1,025
Bell Bros. & Co. (London), Ltd.	1,029

POPLAR.—Contracts Committee. Accepted. Switchboard (£3,368).—A. Reyrolle & Co., Ltd.

ST. PANCRAS.—Contracts and Stores Committee. Recommended. Two 1,000-kVA transformers (£940).—British Electric Transformer Co., Ltd. One eleven-panel l.p. switchboard, with isolating switches, &c. (£1,862).—Metropolitan-Vickers Electrical Co., Ltd. Interconnecting cables (£145).—Standard Telephones & Cables, Ltd.

WESTMINSTER.—Works Committee. Recommended. 12-cwt. electric delivery van (£247) and one electric mechanical horse unit and trailer (£1,200).—Electricars, Ltd.

Middlesex.—Health Committee. Accepted. Internal automatic telephone installation at Harefield Sanatorium (£2,095).—T. Clarke & Co., Ltd. This was the lowest of five tenders, the highest being £2,440. Electrical installation at the Central County Hospital (in lieu of previous tender) (£1,420).—November 29th, 1935) (£1,420).—Pernot & Co., Ltd. Electric food lift at Harefield Place Institution, Uxbridge:

	£
Marryat & Scott, Ltd. (Accepted)	105
Express Lift Co., Ltd.	115
Lift & Hoist Co., Ltd.	119
Hammond Bros. & Champness (1933), Ltd.	136
Waygood-Otis, Ltd.	176
J. & E. Hall, Ltd.	180

Swansea.—Electricity Committee. Accepted. Lighting installations and heating circuits at Tir John power station (£8,929).—Colston Electrical Co., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, January 2nd. Institution, London. 6 p.m. "Applications of the Hot-Cathode Grid-Controlled Rectifier, or Thyratron." Mr. A. L. Whiteley.

Meter and Instrument Section.—Friday, January 3rd. Institution, London. 7 p.m. Inaugural address by Mr. O. Howarth.

Institution of Mechanical Engineers.—Friday, January 3rd. Institution, London. 7 p.m. "The Work of the National Physical Laboratory." Dr. H. J. Gough.

Junior Institution of Engineers.—Friday, January 3rd. Institution, London. 7.30 p.m. Informal meeting. Discussion on "The Prevention of Noise from Engineering Plant—Electric Transformers." To be opened by Mr. D. W. McJannet.

Association of Mining Electrical Engineers (*Kent Sub-Branch*).—Saturday, January 4th. Dover Technical Institute. 6.30 p.m. "Electrical Instruments—Their Construction and Use." Mr. F. C. Knowles.

Notes

Electricity and Coal

In a letter to *The Times* of December 19th Lord Mount Temple, president of the Conjoint Conference of Public Utility Associations, sets out the case for electricity, gas and water undertakings in relation to the proposed increase in the price of coal. No objection would be made, he says, to a temporary increase for raising the miners' wages, provided that increase were made to all users of coal. The mischief of the present position is attributed to recent legislation which has artificially kept alive inefficient collieries, and has had the avowed object of increasing prices rather than of decreasing costs, ignoring the principal that demand for a commodity decreases with cost. Central and district selling schemes are criticised because they neither promote efficiency in production nor encourage increased consumption, and may perpetuate the existing uneconomic conditions. In the national electricity scheme major economies in generation are vitally connected with the cost of coal. The burning of raw coal is to be discouraged on account of smoke and injury to health. Only by expansion of the public utilities can an increased consumption of coal be looked for. The raising of the prices against public utilities (without a corresponding advance in other markets) is an affront to the elementary principles of justice and sound business.

The Midland Ball

We learn from Mr. W. Y. Anderson, the honorary secretary, that as the result of the Midland Electrical Engineers' Ball held in November his committee has sent a contribution of £70 to the I.E.E. Benevolent Fund.

Single-phase Motors

An article bearing this title by Messrs. R. D. Ball & L. Roberts appeared in our last issue. We regret that under the curves on page 851 the run-up torque was stated to be 36 per cent. of the full-load figure, whereas it is actually 56 per cent. The inscriptions under the block at the foot of the page were transposed. The left-hand machine is an enclosed ventilated single-phase motor, while the right-hand one is a large s.p. motor with pulley. The motor illustrated on page 852 is also a single-phase machine.

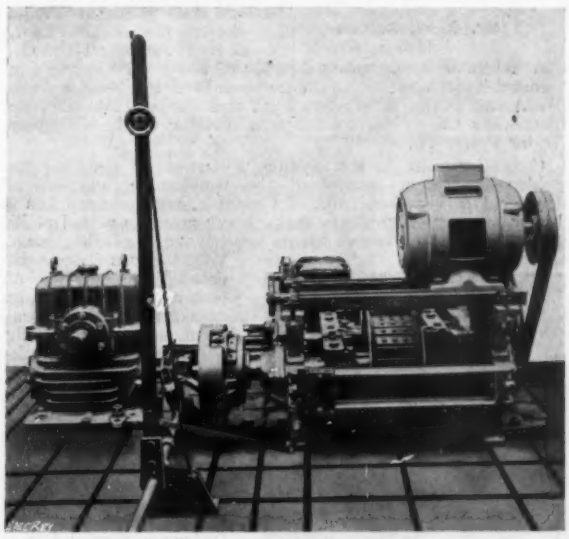
The Electrodeposition of Bronze

Two papers on this subject have recently been published by the International Tin Research and Development Council. No. 28 describes experiments with bi-metallic anodes of tin and copper. It appears that there are fundamental drawbacks to the use of acid oxalate solutions so much favoured by earlier investigators for the production of bronze deposits. On the other hand the alkaline stannate-cuprocyanide type of bath, for which a patent was taken out by the City Auto Stamping Co. in 1934, has given promise of suitability for industrial use. Baths of this type were used in researches described in publication No. 27. Bronze deposits up to a thirty-second of an inch or greater thicknesses were produced. By varying the relative concentrations of the copper and tin salts the composition of the bronze could be controlled. A high rate of deposition is practicable.

An Infinitely Variable Speed Drive

The drive illustrated incorporates a Crofts' variable-speed gear (four to one ratio) driven by an electric motor running at 720 r.p.m. through V-ropes to a constant shaft running at 360 r.p.m. The variable-speed shaft is coupled to a worm-reduction gear through a D/S type rim-friction clutch (hand lever operated) enabling the driven machine to be stopped without stopping the driving motor. A Crofts' radiation rib-cooled worm-reduction gear (nine to one ratio) reduces the final operating speed to 20 r.p.m. as a minimum and 180 r.p.m. as a maximum, within which limits any intermediate speed in infinite gradation can be obtained.

As it was essential that the machine in the present case



Crofts' variable speed arrangement

should always restart at the minimum speed, the clutch lever on disengagement controls the reversible motor; thus ensuring that the variable-speed shaft returns to its lowest speed. Electrical interlocking between the master switch and the clutch lever prevents the machine being brought to rest before declutching. Control of the main drive is by a master switch, while speed variation is obtained by electrical control in which a push button allows the machine to be operated from any position. The provision of a tachometer dial enables the operator to observe the r.p.m. of the driven machine and to vary speed according to requirements.

Batti-Wallahs' Luncheon

Sir Montague Hughman, president, occupied the chair at the monthly luncheon of the Batti-Wallahs' Society on December 19th at the Hotel Metropole, when Sir Geoffrey Clarke was the principal guest. Sir Geoffrey, who is managing director of the Telegraph Construction and Maintenance Co., Ltd., and a director of shipping lines, spoke of some of the difficulties encountered and troubles overcome during the time he was director-general of postal services in India. Mr. G. W. Partridge proposed the vote of thanks.

Electrical Construction Material

The lecture delivered by a senior member of the Institution of Electrical Engineers to the various Students' Sections was given in London on December 13th, by Mr. A. P. M. Fleming, director of the research and education departments of the Metropolitan-Vickers Electrical Co., Ltd. The main hall of the Institution buildings was practically full, and Mr. Fleming's subject was "The Materials of Construction of Electrical Plant and Apparatus—Magnetic, Insulating, Conducting and Mechanical." The speaker dealt first with early problems and their solutions, passing on to the vast number of new materials being developed to meet the exacting needs of modern engineering. For example, under the heading of

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Sir Holberry Mensforth, who recently retired from the chairmanship of Edmundsons Electricity Corporation, Ltd., has now resigned from the board of this company and from the boards of its subsidiary and associated undertakings.

Mr. C. W. Robson

Mr. C. W. Robson, lecturer in electrical engineering at Sunderland Technical College, has been appointed head of the department of electrical engineering and assistant principal at South-East London Technical College, Lewisham. Mr. Robson, who served his apprenticeship with Messrs. Clarke, Chapman & Co., Ltd., gained a diploma in engineering and a degree in electrical engineering at Armstrong College, Newcastle, and was later appointed lecturer in engineering at Darlington.

Mr. A. C. Whitmee and **Mr. R. Nelson,** M.I.E.E., have been elected directors of the Southern Areas Electric Corporation, Ltd., as from January 1st next. Mr. Whitmee is managing director of the Atlas Electric and General Trust and is also on the boards of the Buenos Aires Town and Docks Tramways, Ltd., and the La Plata Electric Tramways Co. Mr. Nelson is a director of the Galloway Water Power Co.

Congratulations to **Mr. Sydney Evershed** on reaching his golden jubilee in control of the well-known business of Evershed & Vignoles, Ltd., of Chiswick, which to-day has a larger number of employés than at any previous period of its history, and is referred to on another page of this issue.

[*G. Toplis, London*

Mr. Sydney Evershed

Fifty years ago he entered the service of Goolden & Trotter as manager of their instrument factory (employing half a dozen men), taking with him samples of the first Evershed voltmeter and ammeter made with his own hands. Later in the same year Goolden & Trotter completed a number of these instruments, some of them being for H.M. Ordnance Survey Office, and in this way the business now carried on by Evershed & Vignoles, Ltd., began in the year 1886. During the entire period the business has been managed or presided over by Mr. Sydney Evershed. In 1895 he and his friends, supported by Mr. Adolph Vines who had joined the company in 1891, purchased the goodwill of the instrument-making business from Easton, Anderson & Goolden, who had succeeded W. T. Goolden & Co. A new company—Evershed & Vignoles, Ltd., was registered in 1895, and the business was taken over with Messrs. Sydney Evershed and E. B. Vignoles as managing directors. Mr. Sydney Evershed retired from the post of managing director in 1924, but he has since taken a very active interest as chairman of the board. Mr. E. B. Vignoles, who ceased to be managing director in 1931 after forty years' connection with the business, also remains on the board. The company's operations continue to expand under the direction of Mr. Adolph Vines, a managing director since 1909, and Lt.-Col. W. A. Vignoles, who was appointed a managing director in 1931.

Mr. G. R. Clark has been appointed manager of the Bradford office of the Hotpoint Electric Appliance Co., Ltd. Mr. Clark served his apprenticeship with Messrs. Cammell Laird & Co., Ltd., and for a short period was in the electrical department of Messrs. Lever Brothers, Ltd., Port Sunlight. He spent five years as representative in the office of the British Thomson-Houston Co., Ltd., after which he took up an appointment with Messrs. G. P. Dennis, Ltd., of Liverpool. From 1928 to the present time he has been with the Hotpoint Electric Appliance Co., Ltd., acting as representative in the Liverpool, Cheshire and North Wales area for the first four years. In 1932 he was appointed sales engineer at the Manchester office, specialising in cooker and water heating sales, and at the beginning of the current year his activities were extended to cover the whole of the Northern area. He took up his new post at Bradford on December 1st.

Mr. G. R. Clark

Mr. A. H. Wynn has joined the board of the Electro Trust, Ltd.

Mr. R. H. Cobbold, having completed his work as change-over engineer with the Winchester Corporation Electricity Department, has been appointed to the engineering staff of Messrs. W. D. & H. O. Wills, Bristol.

Obituary

Sir R. T. Glazebrook.—At the funeral of Sir Richard Glazebrook at St. Peter's, Limpsfield, Surrey, on December 18th, the Institution of Electrical Engineers, of which he was a past-president and honorary member, was represented by Mr. W. M. Mordey, past-president and honorary member. Others present included Sir Frank Smith, Sir William Bragg, Lord Rayleigh, Mr. C. C. Paterson, Dr. E. H. Rayner, Dr. E. Griffiths, representatives of the N.P.L., Director, Executive Committee and staff, and of various scientific bodies.

Mr. L. F. White.—The death occurred suddenly on December 10th of Mr. Leonard F. White, chief draughtsman of the Hackbridge Electric Construction Co., Ltd. Mr. White had been with the company for the past fourteen years, and previous to this had been in the employment of Messrs. Crompton & Co., Ltd., Siemens Bros. Dynamo Works, Ltd., Christy Bros. & Co., Ltd., the General Electric Co., Ltd., the Canadian General Electric Co., Ltd., and the Crocker Wheeler Co., Ltd. He joined the Canadian Expeditionary Force, attaining the rank of captain in the Machine Gun Corps and winning the Military Cross for conspicuous gallantry. After demobilisation he joined the Foster Engineering Co., Ltd., and later the Hackbridge Electric Construction Co., Ltd., and a large number of his friends from these companies attended the funeral on December 14th. Mr. White leaves a widow and daughter.

Mr. A. G. Jackson.—We regret to learn of the death, which occurred recently, of Mr. A. G. Jackson, of the Synchronome Electrical Co., of Australasia, Ltd.

Mr. Francis Goulder, factory manager to the Ever-Ready Co. (Australia), Ltd., has died at the age of forty-four.

Will.—Mr. M. S. Chambers, of Tunbridge Wells, late of Messrs. Preece & Cardew, left £5,735 (net personalty £5,466).

Notes *(Continued from preceding page)*

magnetic materials he first spoke of the once serious problem of ageing and the introduction of silicon-steel, and led up to the most recent developments in materials of high permeability and of high remanence and coercivity, showing some interesting examples of the latter materials. The lecture dealt not only with the problems solved, but also indicated some of those remaining to be solved, and the wide interest aroused was shown by the number of questions asked in the discussion which followed.

Appointments Vacant

District consumers' engineer for the West Gloucestershire Power Co., Ltd.

Civilian wireless instructors for the Electrical and Wireless School, R.A.F., Cranwell, and a temporary assistant technical costs officer in the Directorate of Contracts, Air Ministry.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

ELECTROVEX hospital type radiator.

PERAMITE insulated cable.

Readers should enclose stamped addressed envelopes when making their inquiries.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Security Radio, Ltd.—Private company. Registered December 14th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, wireless engineers, manufacturers of and dealers in gas fittings, wireless and electrical plant and fittings, &c. The first director is M. Wiseman, 85, Seven Sisters Road, N.7.

Neon Tubes, Ltd.—Private company. Registered December 14th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, electric and other sign manufacturers and dealers, advertising and sign specialists and agents, &c. The first directors are: W. E. Woodley, 39, Grove Gardens, N.W.8; and E. A. Sellby, The Homestead, 6, Cumberland Road, Bromley, Kent. Registered office: 26 and 27, Bush Lane, E.C.4.

Trevor Fry, Ltd.—Private company. Registered December 16th. Capital, £5,000 in £1 shares. Objects: To acquire the business of a mechanical and electrical engineer carried on by H. D. Fry as "Thompson & Fry" at 32, Gressenhall Road, S.W.18. The permanent directors are: H. D. Fry (chairman), 32, Gressenhall Road, S.W.18; and T. Oliphant, 23, The Avenue, Worcester Park, Surrey. Registered office: Angell Road Works, Brixton, S.W.19.

Swift Electric, Ltd.—Private company. Registered December 16th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio, telephone, telegraph and television sets, instruments, components and accessories, gramophones, radio gramophones, &c. The permanent directors are: A. E. Wilson and Mrs. H. M. Wilson, both of 148, Regent's Park Road, N.W.1.

Mid-Glamorgan Relay Services, Ltd.—Private company. Registered December 16th. Capital, £20,000 in £1 shares. Objects: To acquire the business of radio relay operators carried on by J. L. Davies and the Ogmore & Garw Radio Relay Co., Ltd. The directors are: J. L. Davies (permanent managing director), "Woodlands," Caerau, and three others. Solicitor: A. King-Davies, Lloyds Bank Chambers, Maesteg, Glam.

Creswick, Ltd.—Private company. Registered in Edinburgh December 13th. Capital, £100 in £1 shares. Objects: To carry on business in all branches of engineering, particularly in electrical engineering, and all kinds of X-ray, electro-medical, optical, surgical, radio and photographic apparatus, &c. The directors are: P. Creswick, 12, Montague Street, Glasgow, C.4, and two others. Registered office: 135, Wellington Street, Glasgow, C.2.

Electricair, Ltd.—Private company. Registered December 14th. Capital, £7,000 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers, wireless manufacturers, &c. The directors are: H. Harwood, Station Garage, Darwen, and five others. Registered office: 26, Brazennose Street, Manchester.

Radio & Television Service, Ltd.—Private company. Registered December 9th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets, accessories and apparatus, &c. The directors are: H. Shaw and Mrs. A. Shaw, both of 99, Great Western Street, Moss Side, Manchester. Registered office: 99, Great Western Street, Moss Side, Manchester.

Returns of Electrical Companies

Brentwood District Electric Co., Ltd.—Satisfaction in full on June 30th, 1935, of debenture dated February 19th and supplemental charge dated March 10th, 1925, and registered February 25th, and March 13th, 1925, respectively. (Notice filed December 12th, 1935.)

Aidas Electric, Ltd.—Further charge on 182, Park Avenue, Willesden, N.W., dated December 12th, 1935, to secure £2,000 (supplemental to mortgage dated November 16th, 1934). Holders: British General Insurance Co., Ltd., 66, Cheapside, E.C.

Strand Electric & Engineering Co., Ltd.—Debenture, dated December 12th, 1935, to secure £1,200, charged on the company's property, present and future, including uncalled capital. Holders: Mansell & Ogan, Ltd., Cecil Works, Power Road, Gunnersbury, W.4.

Architectural Lighting, Ltd.—Satisfaction in full on December 6th, of debenture dated May 8th, and registered May 27th, 1935. (According to the register of mortgages, the debenture registered May 27th, 1935, originally secured £1,000.)

Maybrook Electrical Co., Ltd.—G. E. Sendell, 36, Walbrook, E.C., ceased to act as receiver on December 11th, 1935.

Magbat, Ltd. (formerly Magneto & Battery Services, Ltd.).—Issue on December 1st, 1935, of £200 debentures, part of a series already registered.

Sparks Mead & Co., Ltd.—Debenture dated December 4th, 1935, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: I. H. C. Lake, 42, Mycenae Road, Blackheath, S.E.3.

Archer Electric, Ltd.—Mortgage debenture dated November 29th, 1935, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. H. Johnstone, 22, Bedford Row, W.C.1.

West of England Electric Investments, Ltd.—Satisfaction in full on December 9th, 1935, of two debentures dated March 30th, 1932, and July 6th, 1934, and registered April 1st, 1932, and July 12th, 1934, securing £350,000 and £150,000 respectively, has been registered.

B. P. Electrical Co., Ltd.—Debenture dated December 6th, 1935, to secure £50, charged on the company's property, present and future, including uncalled capital. Holder: R. K. Reed, 201, New King's Road, Fulham, S.W.

W. T. Botten & Co., Ltd.—Particulars filed on December 9th of debentures not exceeding £2,000, authorised April 5th, 1935, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,400.

Radiometers, Ltd.—The nominal capital has been increased by the addition of £404 beyond the registered capital of £200. The additional capital is divided into 8,080 ordinary shares of 1s. each.

Perfect Battery Co., Ltd.—Capital, £100 in £1 shares. Return dated August 13th (filed November 13th), 1935. All shares taken up. £100 paid. Mortgages and charges, nil.

Bagdad Light & Power Co., Ltd.—Capital, £800,000 in £1 shares. Return dated August 7th (filed September 11th), 1935. 200,025 shares issued as ordinary and 249,975 shares as prefer-

Indian Electrical Imports

A SURVEY of the import trade of India during the first six months of the fiscal year (April 1st to September 30th, 1935), prepared by H.M. Senior Trade Commissioner in India, indicates that the total trade in electrical instruments, apparatus, appliances and parts thereof shows a small expansion as compared with the corresponding period of the previous year, from Rs. 129.8 lakhs to Rs. 136.9 lakhs. Although the proportion supplied by the United Kingdom was reduced, this country still secured over 50 per cent. of the trade, the imports amounting to Rs. 72.9 lakhs as compared with Rs. 76.1 lakhs in the previous year. Arrivals from the Unites States increased from Rs. 13 lakhs to Rs. 19.8 lakhs,; Japanese shipments increased from Rs. 7.7 lakhs to Rs. 9 lakhs; those from Germany from Rs. 14.7 lakhs to Rs. 15.2 lakhs; and from the Netherlands from Rs. 6.1 lakhs to Rs. 6.8 lakhs. Imports from Italy showed a slight decrease from Rs. 4.1 lakhs to Rs. 3.8 lakhs.

An analysis shows that there was an appreciable advance in the total value of the trade in electric fans, from Rs. 12 lakhs to Rs. 14.5 lakhs, practically the whole of this increase being obtained by the United Kingdom, which was responsible for Rs. 9.4 lakhs' worth, as against Rs. 7.8 lakhs in the corresponding period of the previous year. Italy was the other principal supplier, but her share decreased from Rs. 3 lakhs to Rs. 2.9 lakhs. There was a contraction in the imports of electric wires and cables from Rs. 34.2 lakhs to Rs. 29 lakhs, the bulk of the trade being with the United Kingdom, whose shipments totalled 22.5 lakhs. The aggregate value of the trade in telegraph and telephone instruments and apparatus also fell from Rs. 8.2 lakhs to Rs. 6 lakhs. The fall is mainly attributable to a contraction in the imports from the United Kingdom from Rs. 6.4 lakhs to Rs. 4.9 lakhs. The imports of gasfilled electric lamps showed an increase from Rs. 7.8 lakhs to Rs. 9.2 lakhs, the United Kingdom's share being Rs. 5.2 lakhs (against Rs. 4.3 lakhs). Imports of vacuum electric lamps remained practically stationary at Rs. 8.1 lakhs, the share of the United Kingdom increasing from Rs. 2.6 lakhs to Rs. 3 lakhs. The value of radio valves imported remained practically steady, the United Kingdom obtaining Rs. 0.18 lakh out of a total of Rs. 0.26 lakh.

The trade in batteries increased by over 50 per cent., the United States, which obtains the bulk of the trade, gaining practically the whole of the expansion. The United Kingdom's share was Rs. 1 lakh. Practically the whole of the imports of accumulators were from the United Kingdom, the total trade rising from Rs. 3 lakhs to Rs. 3.9 lakhs, and the United Kingdom's share from Rs. 2.8 lakhs to Rs. 3.8 lakhs. The imports of electric lighting fittings and accessories (including switches) increased from Rs. 3.4 lakhs to Rs. 4.1 lakhs, mainly due to arrivals from the United Kingdom, which supplied Rs. 2 lakhs (against Rs. 1.5 lakhs). There was an appreciable fall in the imports of electricity meters from Rs. 6 lakhs to Rs. 5.2 lakhs. The United Kingdom enjoyed the bulk of the trade, but its share fell from Rs. 3.5 lakhs to Rs. 3 lakhs.

Electro-medical apparatus imported showed an increase of approximately 30 per cent., at Rs. 2.4 lakhs, of which the United Kingdom accounted for Rs. 0.56 lakhs. The aggregate value of electrical goods and apparatus not enumerated amounted to Rs. 19.7 lakhs, as compared with Rs. 18.5 lakhs. Of this total the United Kingdom obtained more than half, its share being Rs. 10.1 lakhs. The trade in radio apparatus continued to expand, imports being doubled from Rs. 5.7 lakhs to Rs. 11.6 lakhs. Arrivals from the United Kingdom rose from Rs. 1.9 lakhs to Rs. 5.4 lakhs, and those from the United States from Rs. 2.5 lakhs to Rs. 4.6 lakhs.

ence. £250,000 paid. £200,000 considered as paid. Mortgages and charges, nil.

Stratford Wireless, Ltd.—Capital, £600 in £1 shares. Return dated August 30th, 1935. 596 shares taken up. £596 paid. Mortgages and charges, nil.

Electro Insulators, Ltd.—Capital, £1,000 in £1 shares. Return dated July 25th (filed October 21st), 1935. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Antrim Electricity Distribution Co., Ltd.—Capital, £10,000 in £1 shares. Return dated July 26th (filed August 28th), 1935. 6,485 shares taken up. £6,485 paid. Mortgages and charges. nil.

Norman Rose (Electrical), Ltd.—Capital, £3,000 in £1 shares. Return dated August 14th (filed October 12th), 1935. 1,303 shares taken up. £204 paid. £1,099 considered as paid. Mortgages and charges, nil.

John Shaw & Co. (Electrical), Ltd.—Capital, £2,500 in £1 shares. Return dated August 6th, 1935. 2,450 shares taken up. £2,450 paid. Mortgages and charges, £500.

Howells (Electric Motors), Ltd.—Capital, £13,000 in £1 shares. Return dated August 6th, 1935. 12,999 shares taken up. £3,999 paid. £9,000 considered as paid. Mortgages and charges, nil.

Webb Condenser Co., Ltd.—Capital, £1,500 in £1 shares. Return dated January 11th (filed September 27th), 1935. 1,250 shares taken up. £850 paid. £400 considered as paid. Mortgages and charges, nil.

R. Langston Jones & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated August 2nd, 1935. All shares taken up. £5,000 paid. Mortgages and charges, £5,000.

Tube Investments, Ltd.—The nominal capital has been increased by the addition of £1,000,000 beyond the registered capital of £3,300,000. The additional capital is divided into 280,545 ordinary and 719,455 unclassified shares of £1.

Metropolitan Lighting Co., Ltd.—Debenture dated November 20th, 1935, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holder: J. Zeff, 141, High Street, Peckham, S.E.

H. C. Baker, Ltd.—Debenture dated November 18th, 1935, to secure £800 charged on the company's property, present and future, including uncalled capital. Holder: Horace C. Baker, 55, Brantwood Road, S.E.24.

Standard Telephones and Cables, Ltd.—Capital, £2,000,000 in £1 shares. Return dated August 2nd, 1935. All shares taken up. £906,000 paid. £1,094,000 considered as paid. Mortgages and charges, nil.

United Dominions Trust (Electric), Ltd.—Capital, £250,000 in £1 shares. Return dated August 5th, 1935. 100,000 shares taken up. £100,000 paid. Mortgages and charges, nil.

General Installation Co., Ltd.—Capital, £100 in £1 shares. Return dated August 28th, 1935. All shares taken up. £100 paid. Mortgages and charges, £100.

Bogota Telephone Co., Ltd.—Capital, £300,000 in £1 shares. Return dated September 30th, 1935. 258,493 shares taken up. £245,993 paid. £12,500 considered as paid. Mortgages and charges, nil.

Electrolines, Ltd.—Capital, £2,500 in 1,500 preference and 1,000 ordinary shares of £1. Return dated September 19th, 1935. 200 ordinary shares taken up. £200 paid. Mortgages and charges, nil.

Bowyer-Lowe & A.E.D., Ltd.—Capital, £5,000 in £1 shares. Return dated September 30th, 1935. 4,415 shares issued and fully paid up. Mortgages and charges, £800.

J. J. Marr & Co., Ltd.—Capital, £500 in £1 shares. Return dated September 9th, 1935. All shares taken up. £500 paid. Mortgages and charges, nil.

A. J. Dean & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 20th, 1935. All shares taken up. £1,000 paid. Mortgages and charges, nil.

City Notes

Enfield Rolling Mills, Ltd., held its annual meeting on Friday last, when the Earl of Verulam (chairman), who presided, said that the company had not yet reached the profit-earning stage, but business during the year under review had shown a considerable increase. There was a steady drop in the cost per ton of zinc and copper sheets rolled, the quantity turned out per man being larger, and since August all the plant had been operating smoothly and better orders had been received. Enfield Zinc Products, their subsidiary, had also had a very successful year. Under the protection of the Ottawa agreements it was going to be possible to obtain orders for zinc sheets hitherto bought from foreign rollers, and as there was hardly scope for two large zinc mills they had amalgamated with the London Zinc Mills, Ltd. The directors considered the deal entirely satisfactory at the figure of £80,000. The transfer of that company's business to Brimsdown would entail considerable further outlay over the actual purchase price, and additional working capital would be needed to finance the enlarged turnover. The amount that it was considered necessary to provide was £140,000, and the board proposed to increase the nominal capital by £100,000, making it £600,000 nominal in all, and to issue at 20s. 6d. a further 140,000 shares. The report and accounts were adopted and the proposed increase of capital was approved.

The Ceara Tramway Light & Power Co., Ltd.—Presiding at the annual meeting held on December 19th Mr. E. H. R. Trenow (chairman) referred to the remarkable development of the company's business in Ceará (Brazil), but expressed disappointment at seeing the whole benefit wasted by the operation of exchange depreciation and restriction. While the present currency conditions endured what was paid for in that currency did not give a fair price for the essential services rendered. If such a state of affairs continued there would be a gradual starvation of the undertaking and a consequent deterioration of the services. Failure must ultimately ensue unless the return was sufficient not only to meet the expenses and make good the gradual wastage of the installation, but also to provide a moderate return upon the capital employed. The directors were devoting their attention to the task of obtaining sanction for reasonable increases in the company's charges in order to make good the depreciated value of the currency in which they were paid. Notwithstanding the blighting effect of exchange depreciation and the essential need for some revision in charges to compensate for the loss so caused, the local working figures indicated a healthy and progressive undertaking if only Brazil could overcome her financial difficulties. A programme of extensions to the installation in Ceará was being carried out with the aid of the issue of prior lien debenture stock made last May.

The Auckland Transport Board.—The Wellington (N.Z.) correspondent of *The Times* reports that the Auckland Transport Board has resolved, in view of the opinion received from the Board's solicitor, that step be taken to obtain an authoritative decision whether the London interest on the portion of the Auckland City Transport loan of £1,250,000 is payable in the equivalent value of New Zealand currency, and that to this end future London interest payments be tendered in that equivalent, and debenture-holders advised that the Board will facilitate judicial proceedings if wished, including an appeal to the Privy Council. Auckland City Council, as nominal party to the loan contract, was asked to take action on these lines, and the Board further resolved to place the facts before the Minister of Finance, and to place the difference between sterling and New Zealand currency payments in a suspense account. The chairman of the Board, Mr. Mason, who is Attorney-General in the new Government, stated that the payment due on January 1st would be made in New Zealand currency.

The French Thomson-Houston Co.—The Paris correspondent of the *Financial Times* reports that at an extraordinary meeting of the company held on December 19th it was stated, as a reason for the 50 per cent. capital reduction, that the company's reserves had proved insufficient to provide for the exceptional decline in value in the electrical industry, especially in the factories dealing with heavy materials. It was considered preferable to reduce the capital rather than to apply to huge amortisations the whole of the profits which the company might be able to realise in the years immediately ahead. The 220,000,000 fr. (£2,976,000 at current rates) set free by the reduction would be applied to writing off various amortisations connected with the Als-Thom company, a subsidiary of the Thomson-Houston Company, and to providing a special reserve for contingencies. The Thomson-Houston Company would thus, it was pointed out, be relieved from the heavy burden of having to remunerate so large a capital.

Baird Television, Ltd.—Meetings of "A" ordinary, preferred ordinary and deferred ordinary shareholders were held last week under an Order of the Court for the purpose of submitting a scheme of arrangement for the reorganisation of the capital. Sir Harry Greer, who presided, said that when the scheme now proposed became effective, the "A" ordinary shareholders would receive for every share held 10½ twenty per cent. non-cumulative preferred shares of 2s. 6d. each and six deferred ordinary shares of 2s. 6d. When the new issue of shares was made, as a group of preferred and deferred shares, the "A" ordinary shareholders would be entitled to apply for one-half. Subject to the scheme being approved by each class of shareholder and by the Court, it was proposed to make an issue of new preferred shares.

Benham & Sons, Ltd.—Presiding at the annual meeting held on December 17th, Mr. S. J. Benham (managing director) said, in the course of his speech, that the great increase in orders experienced during the year was not reflected in the accounts for the year ended September 30th last. The total value of the orders booked was far greater than in any previous year, and was nearly £100,000 up on the preceding year, including their subsidiary company, whereas the increase in their turnover for the year was under £8,500 and the net profit was actually £71 less than last year. The reason was that a large proportion of the orders was still unexecuted on September 30th; they should, therefore, feel the benefit twelve months hence.

Companies Struck off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Beeches Radio & Electrical Co., Ltd.; Electriclocks & Radio, Ltd.; Electrobak, Ltd.; Goldvick Electrical & Radio Co., Ltd.; Radiomite, Ltd.; Super Radio (Liverpool), Ltd.; Waddon Radio, Ltd.; Waldron Electrical Manufacturers, Ltd.

Telephone Rentals, Ltd., has declared an interim dividend of 3½ per cent. This is at the same rate as a year ago, but in June last the capital was increased by the issue of 400,000 shares of 5s. each.

The Bristol Tramways & Carriage Co. is offering to ordinary shareholders 500,000 ordinary shares of £1 each at 25s. per share. The proceeds will be mainly used for redeeming the outstanding £420,000 4½ per cent. mortgage debentures.

The West of England Electric Investments, Ltd.—The application lists which were opened on December 17th for an issue of £500,000 of 3½ per cent. debenture stock, were closed on the same day, the issue being over-subscribed.

E. K. Cole, Ltd.—The directors announce that the recent issue of 250,000 5½ per cent. first cumulative preference shares of £1 each at 20s. 6d. per share has been heavily over-subscribed.

The Montreal Light, Heat & Power Consolidated has announced a quarterly dividend of $0.38 on the common shares (same).

The Shawinigan Water & Power Co. is paying a quarterly dividend of 15 cents on the common shares, against 13 cents a year ago.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

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5701. "Electrically heated vulcanisers." R. L. Fisher. February 21st, 1934. (438876.)
6150. "Amplifiers for television." Radioakt.-Ges. D. S. Loewe. February 25th, 1933. (439164.)
6737. "Electric regulating systems." British Thomson-Houston Co., Ltd., and T. H. Kinman. March 2nd, 1934. (439166.)
8704. "Overhead electrical conductors." London Electric Wire Co. & Smiths, Ltd., and J. R. Abraham. March 20th, 1934. (438880.)
9247. "Braun tubes and circuits therefor." Radioakt.-Ges. D. S. Loewe. March 29th, 1933. (Addition to 432209.) (438882.)
9715. "Thermionic valves and superheterodyne receivers and like apparatus incorporating the same." Marconi's Wireless Telegraph Co., Ltd. March 28th, 1933. (439032.)
11805. "Electrothermal actuating means for switches and other apparatus." D. A. Howarth. April 19th, 1934. (438958.)
13545. "Ionic amplifiers." S. Ruben. May 5th, 1933. (438961.)
15481. "Electrical couplings of the pin-and-socket type." J. A. Crabtree. May 24th, 1934. (439110.)
15520. "Vapour-electric convertors." General Electric Co., Ltd., and E. Gallizia. May 24th, 1934. Cognate application 30364/34. (438895.)
15736. "Electric sound reproducers." F. R. Carling. May 26th, 1934. (439170.)
15761. "Radio direction finding." R. H. Barfield and L. H. Bainbridge Bell. May 26th, 1934. (438900.)
15875. "Telegraphones and like magnetic recording devices." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. May 28th, 1934. (439178.)
15877. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust and O. E. Keall. May 28th, 1934. (439047.)
15878. "Telephones and like magnetic recording devices." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust and C. J. F. Tweed. May 28th, 1934. (439179.)
15880. "Electron emitting cathodes." Marconi's Wireless Telegraph Co., Ltd., and A. J. Young. May 28th, 1934. (439048.)
15881. "Voltage measuring apparatus." Marconi's Wireless Telegraph Co., Ltd., and L. M. Myers. May 28th, 1934. (439049.)
15882. "Electro-optical devices for controlling light." Marconi's Wireless Telegraph Co., Ltd., and L. M. Myers. May 28th, 1934. (439050.)
15905. "Traffic control signals." Automatic Electric Co., Ltd., and T. P. Priest. May 28th, 1934. (439052.)
16038. "Television and the like scanning systems." C. O. Browne. May 29th, 1934. (439121.)
16168. "Electric operation of lift doors." V. Molander. May 30th, 1934. (439125.)
16270. "Lanterns for electric and other lamps." British Thomson-Houston Co., Ltd., R. Maxted and E. B. Tuppen. May 31st, 1934. (439189.)
16281. "Electrical signalling systems." Automatic Electric Co., Ltd., and P. N. Roseby. May 31st, 1934. (439190.)
16504. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., and W. T. Ditcham. June 2nd, 1934. (439205.)
16505. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. June 2nd, 1934. (439206.)
16926. "Wireless and like receivers." R. E. Spencer. June 7th, 1934. (438972.)
17662. "Television or like apparatus." J. L. Baird, and Baird Television, Ltd. June 14th, 1934. (Cognate applications 22928/34, 28185/34, 23569/34 and 28186/34.) (438903.)
19044. "Television, picture telegraphy and like systems." C. O. Browne. June 27th, 1934. (438905.)
20416. "Control devices particularly for use in the time control of lighting installations." Weston Electrical Instrument Corporation. May 10th, 1934. (439209.)
21004. "Tensioning devices for electrical conducting cords or the like." K. Michelson. July 18th, 1934. (Convention date not granted.) (439130.)
21282. "Electric condensers." Soc. Anon. des Manufactures des Glaces et Produits chimiques de St. Gobain, Chauny & Cirey. July 25th, 1933. (439064.)
21813. "Safety switch devices for electrically heated apparatus." L. Satchwell. July 25th, 1934. (438983.)
24777. "Electric-discharge lamps." General Electric Co Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) August 28th, 1934. (438910.)
25879. "Television or like apparatus." J. L. Baird, and Baird Television, Ltd. September 8th, 1934. (438989.)
25902. "Switching arrangements in automatic telephone systems." Telefonaktiebolaget, L. M. Ericsson. September 8th, 1933. (Cognate application 25903/34.) (439067.)
27579. "Indicator for electric lighting systems." W. A. B. Ames, J. Crawford, United Electrical Co. (Coolex), Ltd., F. R. Pendergast and S. E. Sherman. September 26th, 1934. (439069.)
28219. "Alternators." C. A. Parsons & Co., Ltd., and W. D. Horsley. October 2nd, 1934. (438992.)
30823. "Electric transformers." A. H. Brackensey, and Franco British Electrical Co., Ltd. October 26th, 1934. (439217.)
30927. "Supply of electrical energy to loads of variable parameters." Washington Institute of Technology, Inc. November 1st, 1933. (439074.)
33600. "Mechanical interlocking devices, particularly for electric switches and contactors." Allen West & Co., Ltd., and H. H. Matthews. November 22nd, 1934. (439077.)
34746. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. December 1st, 1933. (438917.)
35473. "Electromagnetic track brakes." Knorr-Bremse Akt.-Ges. November 12th, 1934. (438997.)

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337. "Electron-discharge devices." Standard Telephones & Cables, Ltd. May 3rd, 1934. (439000.)
384. "Electromagnetic relays." B. Piesker and W. Goy. January 6th, 1934. (439138.)
2000. "Electric furnaces." Y. R. E. Cornelius. January 19th, 1934. (439080.)
2007. "Encasing of electric condensers." Elektrizitäts-Akt.-Ges. Hydrawerk. January 20th, 1934. (439081.)
2149. "Thermionic valves and superheterodyne receivers and like apparatus incorporating the same." Marconi's Wireless Telegraph Co., Ltd. March 28th, 1933. (Divided out of 9715/34.) (439082.)
2511. "Electric fusible cut-outs." Allen West & Co., Ltd., and E. S. Heathcote. January 25th, 1935. (439003.)
2572. "Electron-discharge devices." Telefunken Ges. für Drahtlose Telegraphie. January 30th, 1934. (439004.)
7445. "Means for transmitting synchronising signals in television." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. March 17th, 1934. (439146.)
7968. "Self inductance coils." Ideal-Werke Akt.-Ges. für Drahtlose Telephonie. April 18th, 1934. (439147.)
10376. "Modulated carrier-wave systems." Telefunken Ges. für Drahtlose Telegraphie. April 3rd, 1934. (439014.)
10834. "Auxiliary recording arrangements for automatic telephones." H. Broder. April 7th, 1934. (439015.)
10869. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. June 9th, 1934. (438934.)
12739. "Cooking equipments with direct electric-heated cooking vessels." E. Reich. April 29th, 1935. (438938.)
12785. "Photo-electric exposure meters and attachments therefor." Zeiss Ikon Akt.-Ges. April 28th, 1934. (439224.)
13143. "Connectors for attaching flexible conductors to dynamo brushes, especially laminated brushes." Siemens-Planiawerke Akt.-Ges. für Kohlefabrikate. December 18th, 1934. (439094.)
13429. "Electrical condensers having slow-motion drives." General Electric Co., Ltd., R. Gosden and S. G. Hunter. May 7th, 1935. (439152.)
14470. "Electro-optical image-transmission systems." Electrical Research Products. May 19th, 1934. (439225.)
14826. "Grids for electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 8th, 1934. (439153.)
16812. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. June 12th, 1934. (439227.)
18723. "Electric sewing machine cabinet." W. C. Fairweather. (Singer Manufacturing Co.). July 1st, 1935. (438948.)
19011. "Television." W. C. Bailey. July 3rd, 1935. (439229.)
19968. "High frequency electrical circuits." Federal Telegraph Co. October 31st, 1934. (Addition to 426727.) (439025.)
19969. "Arrangements for transmitting broadcast messages by means of high frequency currents in telephone exchange networks." C. Lorenz Akt.-Ges. July 13th, 1934. (439026.)
19974. "Arc-welding systems." Westinghouse Electric & Manufacturing Co. August 15th, 1934. (438949.)
20903. "Electric snap switches." Igranic Electric Co., Ltd. August 25th, 1934. (439028.)
21384. "Electron-discharge devices." Standard Telephones & Cables, Ltd. September 7th, 1934. (439159.)
21557. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. June 9th, 1934. (Divided out of 438934.) (438950.)
21793. "Spring contact for electrical fittings specially applicable to fuse fittings." G. P. Dennis. August 1st, 1935. (439030.)
23540. "Electric plug-in couplings." R. T. Waite. April 5th. 1935. (Divided out of 13466/34.) (439161.)
23669. "Radio receiving systems, and circuits and apparatus therefor." D. W. Pugh and Baird Television, Ltd. August 31st, 1934. (Divided out of 25118/34.) (439103.)
25351. "Lecher-wire systems." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 5th, 1934. (439104.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 18th:—

Goblin. No. 559666. Class 6. Electric washing, refrigerating and floor polishing machines. No. 559667. Class 13. Electric kettles, irons and lamps (ordinary).—The British Vacuum Cleaner and Engineering Co., Ltd., Parsons Green Lane, Fulham, London, S.W.6.

Signaphon. No. 562664. Class 6. Automatic signalling apparatus for operating telephone systems in an emergency.—Louis Serrure, 92, Boulevard de Courcelles, Paris, France. (British representative: William Charles Crocker, 21, Bucklersbury, London, E.C.4.)

Searsint (lettering and design). No. 564459. Class 8. Radio receiving sets and parts thereof, radio batteries, accumulators, electron radio tubes, and loud speakers.—Sears, Roebuck & Co., Chicago, Ill., U.S.A. (British representatives: Boult, Wade and Tennant, 112, Hatton Garden, London, E.C.1.)

Vitalec (lettering and design). No. 564002. Class 50. Manual exercising apparatus.—Vitalec Electrical Products, Ltd., Westminster Bank Chambers, 329, High Holborn, London, W.C.1.

The E.A.W. (Croydon and District Branch)

A bridge and whist drive was held at the residence of Mrs. A. Rendell-Baker, chairman of the Croydon and District Branch of the E.A.W., on December 12th, when 124 people took part. The proceeds, which amounted to £25, have been given to the Cancer Clinic at the Croydon General Hospital. The Committee wishes to acknowledge the generosity of the electrical manufacturers who supplied the prizes.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abbey Hulton (STAFFORDSHIRE).—Catholic church, Abbey Lane; Rev. M. Power.

Accrington.—Extensions to Broad Oak Works; Calico Printers Association, Ltd.

Barnes (SURREY).—Flats (120), Wilderness estate, for Frank Mousley; W. Boyd Scott, architect. Rebuilding, factory, Thorne Passage, for Automatic (Barnes, 1932), Ltd.

Barnstaple.—Houses (20), Derby Road site; borough surveyor.

Becontree.—Shopping centre, Green Lane and Greenside; J. C. Tilley.

Bedford.—Girls' school, Cardington Road; Harpur Trust governors.

Billinge (LANCASHIRE).—Houses (60); U.D.C. surveyor.

Bilston.—Rebuilding the Alhambra Cinema; R. Satchwell, architect, New Street, Birmingham.

Blackpool.—Houses (49), Baldwin Grove; R. Fielding & Son. Bus station, Tyldesley Road; Ribble Motor Services, Ltd.

Border (CUMBERLAND).—Houses (26), Cummersdale; housing architect, 5-7, Victoria Place, Carlisle.

Bromley (KENT).—Houses (40), Beverley estate, Bromley Common; A. E. Westerman. Extensions to Bromley and District Hospital (£35,000); Courtley & Fairbairn, Ltd., builders.

Burton-on-Trent.—Extensions to Town Hall (£60,000); borough surveyor.

Cannock.—Reconstruction of the Forum cinema; R. Satchwell, architect, New Street, Birmingham.

Cardiff.—Houses (184), Ely and Tremorfa estates; C. Brown & Co., E. Addicott & Son, and W. S. Eglen, Ltd.

Carlisle.—Boys' and girls' senior schools, Currock; director of education.

Carshalton.—Library and welfare centre, Middleton Road; U.D.C. surveyor.

Chard.—Houses (20); D. R. Nicholls, architect, 21a, High Street.

Chesterfield.—Houses (28), Sheffield Road; borough engineer.

Chippenham.—Extensions to hospital, including ward block, for the Joint Isolation Hospital Committee; T. Walker, county architect, Trowbridge.

Colchester.—Houses (22); H. Collins, borough engineer.

Combe Martin (DEVONSHIRE).—Shops and residences, for F. Norman; Oliver & Son, architects, Barnstaple.

Coulsdon.—Houses, Chaldon Way; H. Miller & Co. Café and flats, Sherwood Oaks, near Oaks Lane; C. E. Hanscomb, architect.

Croydon.—School, Ham Farm estate, for Borough E.C.; Burnand & Pickett, Ltd., builders, Woodcote Road, Wallington.

Dagenham (ESSEX).—Houses and bungalows, Frizlands Farm site, and houses, Mill Park estate; U.D.C. surveyor.

Darlington.—Houses, Hurworth Grange estate; H. Parker & Co., architects, 153, Cheapside, London, E.C.2.

Dresden (STAFFORDSHIRE).—Estate development for Mr. Lathe, Chaplin Road; Beckett & Bloore.

Eton.—Extensions to Eton College (£30,000); College authorities.

Exeter.—Extensions to Bishop Blackhall School; governors.

Featherstone (YORKSHIRE).—Catholic church, Gallagher & Co., builders, Castleford.

Folkestone.—Extensions to Royal Victoria Hospital; Elcock & Sutcliffe, architects, Northumberland Avenue, London, W.C.2.

Gainsborough.—Extensions to Foxby Hill Hospital; U.D.C. surveyor.

Gateshead-on-Tyne.—Houses (25), High Fell estate; E. P. Calderwood, architect, Chow Dene estate. Houses (22), Thornwood Gardens; W. Leech, builder, Coutts Road, Newcastle-on-Tyne. Factory and offices for T. Fentimann & Sons, Askew Road West; J. W. Corking, architect, 16, West Street. Alterations to the Grand Hotel for J. Aitchison & Co.; P. L. Browne & Son, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne. Alterations to the Palace Theatre, Sunderland Road; G. C. Young, architect, 12, Grange Road West, Jarrow-on-Tyne.

Glamorgan.—Alterations to Pontardulais Council School; D. J. Parry, deputy clerk to C.C.

Glossop.—R.C. day schools, St. Mary's parish; Rev. Canon Winder.

Gloucestershire.—County library and offices, Berkeley Street; county architect.

Grantham.—Houses (20). Harrowby Hall, for the Land Settlement Association, Ltd.; Pakington & Enthoven, architects, 2, Bedford Square, London, W.C.1.

Guildford.—Houses, Cherry Tree Avenue; H. Ashenden. Houses (90), Wonersh Park; H. Gaze & Co., Kingston-on-Thames. Metal window factory, Woking Road; E. C. Dyster. Showrooms and offices, North Street; Holloways Garage, Ltd.

Hamilton.—Houses (300); burgh surveyor.

Hampshire.—Senior school (280 places), Butlock's Heath, for County E.C.; A. L. Roberts, county architect, The Castle, Winchester.

Hanley.—Tile factory, Broom Street; Smith & Warrilow. Alterations to Roxy Cinema, Glass Street; Paxon & Chambers.

Hebburn-on-Tyne.—Houses (130); Page, Son & Bradbury, architects, 67, King Street, South Shields.

Huddersfield.—Business stores for Prices (Tailors), Ltd.; Philip S. B. Nicolle, architect.

Ipswich.—Development of St. John's estate, Cauldwell Hall Road; Mrs. Nora Davey and Mrs. Kathleen Howes. Development of Springfield estate, Springfield Lane; W. A. Keys. Trolley bus depôt, Nacton Street; borough engineer.

Irish Free State.—(COON, CO. KILKENNY).—Technical school, for the County Kilkenny Vocational E.C.; T. Kelly, architect, 35, Patrick Street, Kilkenny. (DROGHEDA, CO. LOUTH).—Rebuilding of St. Peter's Presbytery; William H. Byrne & Son, architects, 20, Suffolk Street, Dublin. (GLENBEIGH, CO. KERRY).—Creamery, for the Newmarket Dairy Co. (1932), Ltd.; John Gallivan, engineer, Killarney, Co. Kerry. (TULLAMORE, CO. OFFALY).—County hospital, for the Offaly Board of Public Health, Tullamore; Scott & Good, architects, 36, South Frederick Street, Dublin.

Keith.—Houses (105) for slum clearance and overcrowding schemes; Council's surveyor.

Kenton (MIDDLESEX).—Catholic school, Claremont Avenue; Rev. Maurice T. Beckett.

Kidderminster.—Houses (22), Broadwaters; W. Lindley.

Kingsbury (MIDDLESEX).—Catholic school, Hay Lane; Rev. G. L. Smith.

Lancashire.—Extensions to Woodplumpton Catforth Council School, near Preston; county architect, Preston.

Lincoln.—Extensions to school, for the Governors of Lincoln School; clerk.

London.—(BERMONDSEY).—Extensions to 138-156, Drummond Street; Wallis, Gilbert & Partners, 15, Elizabeth Street, S.W.1. (BETHNAL GREEN).—Tenements, Waterloo House site (£150,000), and Ada Place (£46,575); L.C.C. architect. (BRIXTON).—Houses, Greyhound track site, Brixton Road; L.C.C. architect. (DEPTFORD).—Reconstruction of Addey Street (£92,000); L.C.C. architect. (HACKNEY).—Maternity centre, Richmond Terrace; borough engineer. Tenements, Clapton Common (£24,816); Higgs & Hill, Ltd., Crown Works, South Lambeth Road, S.W.8. (HAMMERSMITH).—Cinema, King Street; Associated British Cinemas, Ltd., 30, Golden Square, W.1. (PADDINGTON).—Flats, Artesian Road and North Wharf area (£25,000); borough engineer. (POPLAR).—Factory, Three Mills Lane; Kemball, Bishop & Co., Ltd., Chemical Manufacturers, Crown Chemical Works, Bromley, E.3. (ST. PANCRAS).—Houses, Kentish Town and Carlow Street; borough engineer. (STEPNEY).—Houses, Pennington Street (£110,000); L.C.C. architect. (STOKE NEWINGTON).—Flats, Lordship Terrace (£55,346); R. J. Rowley, Ltd., Belmont Works, Belmont Avenue, N.17. (WESTMINSTER).—Highways depôt foundations (£29,932); W. & C. French, Ltd., 50, Epping New Road, Buckhurst Hill. Multi-storied garage, Brompton Road; Thomas Tilling, Ltd., 20, Victoria Street, S.W.1. (W.1).—Conversion of Prince Edward Theatre, Old Compton Street; Hay Hill Syndicate, Ltd.

Maltby (YORKSHIRE).—Cinema and shops, High Street; D. Craig, 1, Mylnhurst Road, Sheffield.

March.—Houses, Badgeney site, Creek Road and elsewhere; U.D.C. surveyor.

Meir (STAFFORDSHIRE).—Cinema, Uttoxeter Road; Broadway Cinema Co., Ltd.

Middlesbrough.—Houses (79), near Ullswater Avenue; T. and G. Duncanson, builders, "Beechwood," Acklam, Linthorpe.

Middlesex.—Further extensions to Central County Hospital (£75,000), and rebuilding, North County Hospital (£500,000); county architect. Reconstruction of Tottenham Polytechnic for County E.C.

Monkseaton.—Cinema, Seatonville Road, for Regal Cinema, Monkseaton, Ltd.; Dixon & Bell, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Houses (169 acres), near Ponteland Road, for C.C.; R. G. Roberts, housing architect, 18, Cloth Market. Houses, West Denton estate, for Phillips & Henderson; Hetherington & Wilson, architects, County Chambers, Westgate Road. Chapel, &c., Osborne Road, for the Convent de St. Marie Reparatice; Dunn, Hansome & Fenwicke, architects, Emerson Chambers.

Newport (MONMOUTHSHIRE).—Museum and art gallery, Clytha Park; Libraries, Museum and Art Gallery Committee.

Peterborough.—Development of Longthorpe; Milton (Peterborough) Estates, Ltd.

Pontefract.—Offices and works, Baghill Lane, for Pearsons (Pontefract), Ltd.

Purley.—Houses (49), Derwent Drive; J. Laing & Son, Ltd.

Radlett (HERTFORDSHIRE).—Shops, flats and cinema, Watling Street, for G. Miller and T. J. Foord.

Ramsgate.—Hotel, Cliffs End; Sir Lacon Threlford.

Rotherham.—Houses (268); Vincent Turner, borough engineer.

St. Helens (LANCASHIRE).—Houses (50), Sorogold Street site; A. P. Statham, borough engineer.

Salisbury.—Houses (70), Pembroke Park estate; city surveyor.

Southend-on-Sea.—Enlargement to Rochford Public Assistance Institution for P.A.C.

Stafford.—Houses (190), Stone Road; West Heath Estates, Ltd. Houses (115), Queensville, for W. T. Strace.

Staffordshire.—Extensions to Leek Council School; director of education, Stafford.

Stoke-on-Trent.—Commercial hotel, shop and houses, Stone Road; R. J. Moore. Development of Holden Farm estate, Sneyd Green; Shenton, Bros. Five-storey buildings, for Twyfords, Ltd., Newcastle Road; R. Scrivener & Sons, architects, Hanley. Extensions to St. Mary's works, Longton High Street; T. C. Wild & Sons, Ltd. Extensions to Tuscan works, Longton; R. H. & A. L. Plant.

Sunderland.—Houses (1,260), Ford estate and High Southwick estate; borough engineer.

Swansea.—Houses (28), Harlech Crescent; T. & G. Spragg. Houses (352), Mayhill estate, and grammar school, Sketty Hall estate; borough architect. Library, Singleton; University College Council. Post office, Mayhill Road; Ivor John.

Tamworth.—Swimming baths, Castle Pleasure Grounds; borough engineer.

Tynemouth.—Houses (26) for aged, Ridges estate; borough engineer.

Wolverhampton.—Extensions to Wolverhampton and Midland Counties Eye Infirmary (£20,000); Lavender & Twentyman, architects.